Mathematics – 7
(Part – I)

1. Large Numbers Around Us

Work it Out—1

1. One lakh is equal to 1,00,000.

Since 83,000 is smaller than 1,00,000, so it is less than one lakh.

To find the exact difference :

1,00,000 – 83,000 = 17,000

Ans. 83,000 is 17,000 less than one lakh.

2. One lakh is equal to 1,00,000.

Since 1,13,000 is greater than 1,00,000, so it is more than one lakh.

To find the exact difference :

1,13,000 – 1,00,000 = 13,000

Ans. 1,13,000 is 13,000 more than one lakh.

3. From the previous questions :

Result 1 :

83,000 is 17,000 less than one lakh.

Result 2 :

1,13,000 is 13,000 more than one lakh.

Now compare the differences from one lakh :

Difference in Question 1 = 17,000

Difference in Question 2 = 13,000

Since 17,000 is greater than 13,000, 83,000 is farther away from one lakh than 1,13,000. Also, comparing the two numbers directly : 1,13,000 is greater than 83,000.

Ans. The result from Question 1 (17,000) is greater than the result from Question 2 (13,000).

This means 83,000 has a larger gap from one lakh than 1,13,000.

Work it Out—2

1. Using the Indian Place Value System (Lakhs and Crores), we can break down and name each number :

(a) 1,20,001 : One lakh twenty thousand one.

(b) 5,05,202 : Five lakh five thousand two hundred two.

(c) 15,75,000 : Fifteen lakh seventy-five thousand.

(d) 80,23,225 : Eighty lakh twenty-three thousand two hundred twenty-five.

(e) 31,00,001 : Thirty-one lakh one.

(f) 79,05,030 : Seventy-nine lakh five thousand thirty.

2. (a) 21,36,091 (b) 1,09,103
(c) 46,00,202 (d) 91,06,200
(e) 40,01,012 (f) 66,55,000

Work it Out—3

1. Expressions for obtaining the numbers

(a) 9,600

Way 1 : 9 × 1,000 + 6 × 100

Way 2 : 96 × 100

(b) 40,389

Way 1 : 4 × 10,000 + 3 × 100 + 8 × 10 + 9 × 1

Way 2 : 403 × 100 + 89 × 1

(c) 69,452

Way 1 : 6 × 10,000 + 9 × 1,000 + 4 × 100 + 5 × 10 + 2 × 1

Way 2 : 69 × 1,000 + 452 × 1

(d) 3,83,503

Way 1 : 3 × 1,00,000 + 8 × 10,000 + 3 × 1,000 + 5 × 100 + 3 × 1

Way 2 : 383 × 1,000 + 5 × 100 + 3 × 1

(e) 8,88,888

Way 1 : 8 × 1,00,000 + 8 × 10,000 + 8 × 1,000 + 8 × 100 + 8 × 10 + 8 × 1

Way 2 : 888 × 1,000 + 888 × 1

(f) 9,00,025

Way 1 : 9 × 1,00,000 + 2 × 10 + 5 × 1

Way 2 : 9,000 × 100 + 25 × 1

(g) 72,58,000

Way 1 : 7 × 10,00,000 + 2 × 1,00,000 + 5 × 10,000 + 8 × 1,000

Way 2 : 725 × 10,000 + 8 × 1,000

(h) 96,00,243

Way 1 : 9 × 10,00,000 + 6 × 1,00,000 + 2 × 100 + 4 × 10 + 3 × 1

Way 2 : 96 × 1,00,000 + 243 × 1

2. Button Press Logic

(a) Smallest 7-digit number with exactly 16 button presses : The smallest 7-digit number starts with 10,00,000.

1 press of 10,00,000 = 1,000,000.

We have 15 more presses to use. To keep the number smallest, we use them on the smallest button (the 1 button).

Result : 1,000,015.

(b) Minimum presses for 4-digit numbers :

Smallest 4-digit number (1,000) : 1 press (Click the 1,000 button once).

Largest 4-digit number (9,999) : 36 presses (9 × 1,000 + 9 × 100 + 9 × 10 + 9 × 1).

(c) Can you make 897 with different numbers of button presses? Yes.

Way 1 : 8 × 100 + 9 × 10 + 7 × 1 = 24 presses.

Way 2 : 897 × 1 = 897 presses.

Way 3 : 89 × 10 + 7 × 1 = 96 presses.

3. Smallest number of button clicks (Least Clicks)

To get the smallest number of clicks, you click the largest possible place value buttons until you reach the total. This matches the digits in the number's place value.

(a) 9,600 : 9 + 6 = 15 clicks

(b) 40,389 : 4 + 0 + 3 + 8 + 9 = 24 clicks

(c) 69,452 : 6 + 9 + 4 + 5 + 2 = 26 clicks

(d) 3,83,503 : 3 + 8 + 3 + 5 + 0 + 3 = 22 clicks

(e) 8,88,888 : 8 + 8 + 8 + 8 + 8 + 8 = 48 clicks

(f) 9,00,025 : 9 + 0 + 0 + 0 + 2 + 5 = 16 clicks

(g) 72,58,000 : 7 + 2 + 5 + 8 + 0 + 0 + 0 = 22 clicks

(h) 96,00,243 : 9 + 6 + 0 + 0 + 2 + 4 + 3 = 24 clicks

4. The Connection

The smallest number of button clicks is equal to the **sum of the digits** of the number. This is because each digit tells you exactly how many times you must press that specific place-value button (e.g., if there is a 9 in the thousands place, you must press the 1,000 button 9 times).

5. Indian Place Value and One Crore

The expressions represent Indian place value notation because the buttons (1, 10, 100, 1000, 10000, 1 Lakh, 10 Lakh) match the columns used in Indian Math to organize numbers.

If 10,00,000 is pressed ten times :

Number obtained : 1,00,00,000.

Number of zeros : 7 zeros.

How it is read : One Crore (or 100 Lakh).

Work it Out—4

1. Place Value Notations and Number Names

(a) 5068343

Indian : 50,68,343 (Fifty lakh sixty-eight thousand three hundred forty-three)

American : 5,068,343 (Five million sixty-eight thousand three hundred forty-three)

(b) 29068462

Indian : 2,90,68,462 (Two crore ninety lakh sixty-eight thousand four hundred sixty-two)

American : 29,068,462 (Twenty-nine million sixty-eight thousand four hundred sixty-two)

(c) 30220044

Indian : 3,02,20,044 (Three crore two lakh twenty thousand forty-four)

American : 30,220,044 (Thirty million two hundred twenty thousand forty-four)

(d) 870460234

Indian : 87,04,60,234 (Eighty-seven crore four lakh sixty thousand two hundred thirty-four)

American : 870,460,234 (Eight hundred seventy million four hundred sixty thousand two hundred thirty-four)

(e) 404040444

Indian : 40,40,40,444 (Forty crore forty lakh forty thousand four hundred forty-four)

American : 404,040,444 (Four hundred four million forty thousand four hundred forty-four)

(f) 728642023

Indian : 72,86,42,023 (Seventy-two crore eighty-six lakh forty-two thousand twenty-three)

American : 728,642,023 (Seven hundred twenty-eight million six hundred forty-two thousand twenty-three)

(g) 2596002482

Indian : 2,59,60,02,482 (Two hundred fifty-nine crore sixty lakh two thousand four hundred eighty-two)

American : 2,596,002,482 (Two billion five hundred ninety-six million two thousand four hundred eighty-two)

(h) 72864232929

Indian : 7,286,42,32,929 (Seven thousand two hundred eighty-six crore forty-two lakh thirty-two thousand nine hundred twenty-nine)

American : 72,864,232,929 (Seventy-two billion eight hundred sixty-four million two hundred thirty-two thousand nine hundred twenty-nine)

(i) 7428642028

Indian : 7,42,86,42,028 (Seven hundred forty-two crore eighty-six lakh forty-two thousand twenty-eight)

American : 7,428,642,028 (Seven billion four hundred twenty-eight million six hundred forty-two thousand twenty-eight)

(j) 56428396421

Indian : 5,642,83,96,421 (Five thousand six hundred forty-two crore eighty-three lakh ninety-six thousand four hundred twenty-one)

American : 56,428,396,421 (Fifty-six billion four hundred twenty-eight million three hundred ninety-six thousand four hundred twenty-one)

2. Writing in Indian Place Value Notation

(a) 2,09,26,349 **(b)** 1,04,30,67,412

(c) 8,04,60,50,403 **(d)** 9,612,20,57,371

3. Writing in American (International) Place Value Notation

(a) 12,653,486 **(b)** 230,729,404

(c) 103,004,444 **(d)** 770,707,700

4. Comparison of Numbers

(a) 30 thousand < 3 lakh
(30,000 < 3,00,000)

(b) 600 lakh > 6 million (6,00,00,000 > 6,000,000. Note : 600 lakh is 60 million.)

(c) 700 thousand < 7 million
(700,000 < 7,000,000)

(d) 243 crore > 24 billion (Correction : 243 crore = 2.43 billion. Therefore, 243 crore < 24 billion.)

(e) 228 thousand > 2 lakh
(228,000 > 2,00,000)

Work it Out—5

1. Cities with nearly the same population increase is Hyderabad and Bengaluru (or **Chennai and Hyderabad**).

Reasoning : In most datasets, Hyderabad increased by roughly 13-15 lakh and Bengaluru by about 15-18 lakh. If the table shows "Metropolitan" or "Agglomeration" data, Chennai and Hyderabad often show very similar decadal growth numbers (around 1.5 – 2 million people).

2. City with half of Mumbai's population is Ahmedabad (or **Bengaluru**).

Reasoning : Mumbai's population in 2011 was approximately 1.84 crore (18.4 million).

Half of 18.4 is **9.2 million**.

Bengaluru (8.4 million) is very close, but in some textbooks, **Ahmedabad** (6.3 million) is used if the problem refers to "Municipal" limits rather than the full metropolitan area. Based on the 1.84 crore figure, **Bengaluru** is the closest approximation to "half."

3. Highest percentage growth among Bengaluru, Hyderabad, Ahmedabad is Bengaluru.

Reasoning : Bengaluru grew by nearly **47%** between 2001 and 2011. This

rate was much higher than Hyderabad (~31%) and Ahmedabad (~22%) during that same decade.

4. Estimated total population of top 5 cities in 2011 is as follows :

The Cities : Mumbai, Delhi, Bengaluru, Hyderabad, Ahmedabad.

Estimation : 1.8 cr + 1.6 cr + 0.8 cr + 0.8 cr + 0.6 cr = 5.6 crores.

It is Approximately **5.6 to 5.7 crores**.

5. Cities crossing from below 20 lakh to over 30 lakh is Jaipur and Pune (or **Surat**).

Reasoning : * **Jaipur :** 2001 (~23 lakh) to 2011 (~30 lakh). **Note :** *Some tables show Jaipur starting just above 20 lakh, in which case Surat is the better answer.*

Surat : In many tables, Surat's municipal population was around 14-16 lakh in 2001 and exploded to 44 lakh by 2011.

6. Chennai's population multiplier is 1.1 (approximately).

Reasoning : Chennai's population went from roughly 4.3 million (2001) to 4.6 million (2011) in municipal limits.

So, you would multiply the 2001 population by **1.1** (which represents a 10% increase) to get close to the 2011 figure.

Work it Out—6

1. Evaluating Expressions (Easiest Way)

(a) 50 × 2342 × 2

Method : Regroup (50 × 2) first.

Calculation : 100 × 2342 = **234,200**

(b) 2344 × 25

Method : Use 25 = 100 / 4.

Calculation : (2344 / 4) × 100

= 586 × 100 = **58,600**

(c) 4 × 4261 × 25

Method : Regroup (4 × 25) first.

Calculation : 100 × 4261 = **426,100**

(d) 184 × 125

Method : Use 125 = 1000 / 8.

Calculation : (184 / 8) × 1000

= 23 × 1000 = **23,000**

(e) 3241 × 25 × 40

Method : Regroup (25 × 40) first.

Calculation : 3241 × 1000 = **3,241,000**

(f) 58246 × 5 × 5 × 2 × 2

Method : Pair the 5s and 2s to make 10s.

(5 × 2) × (5 × 2) = 10 × 10 = 100.

Calculation : 58246 × 100 = **5,824,600**

2. Quick Solutions

(a) 224 × 25 = **5,600**

(b) 1864 × 125 = **233,000**

(c) 250 × 24 = **6,000** (Think 250 × 4 × 6 = 1000 × 6)

(d) 2500 × 120 = **300,000** (Think 2500 × 4 × 30 = 10000 × 30)

(e) 500 × 4 × 25 = **50,000** (Think 500 × 100)

(f) **100** × **100** = 10,000

(g) **35** × **1,00,000** = 35,00,000 (Indian) or **35** × **100,000** = 3,500,000 (International)

Work it Out—7

1. Traveling to the Moon (Distance : ~3,84,400 km)

Travel in one year : 365 days × 100 km = **36,500 km**

Travel in 10 years : 10 × 36,500 km = **3,65,000 km**

How long to reach the Moon? Since the distance is about 3,84,400 km, it would take slightly more than 10 years (about **10.5 years**) to reach the Moon.

2. Reaching the Sun (Distance : 14,96,00,000 km)

Travel in one year : 365 days × 1,000 km = 3,65,000 km

Travel in 100 years : 100 × 3,65,000 km = **3,65,00,000 km** (3 crore 65 lakh km)

Conclusion : No, you cannot reach the Sun. Even after 100 years, you would only cover about **3.65 crore km**, which is much less than the **14.96 crore km** distance to the Sun.

3. Interesting Calculations

(a) Weight of coins :

Weight of 1,000 coins : 1,000 × 5 grams = 5,000 grams = **5 kg**.

Yes, he can lift 1,000 coins.

Weight of 1,00,000 coins : 1,00,000 × 5 grams = 5,00,000 grams = **500 kg**.

Conclusion : No, he cannot pick up one lakh coins together, as 500 kg is too heavy for a person to lift.

(b) Counting one million coins :

Time needed : 1,000,000 seconds.

Seconds in a day : 24 hours × 60 minutes × 60 seconds = **86,400 seconds**.

Calculation : 10,00,000 / 86,400 = **11.57 days**.

Conclusion : No, he cannot count them in a single daytime; it would take about 11 and a half days of non-stop counting.

(c) Babies born in a day :

Babies per day : 9.3 babies × 86,400 seconds = **8,03,520 babies**.

Conclusion : No, ten lakh (1,000,000) babies will not be born in a day; the total is closer to 8 lakh.

(d) Human tower to the Moon :

Height of tower : 1.5 Arab people × 1 metre = **1,50,00,00,000 metres**.

Convert to km : 15,00,000 km.

Distance to Moon : ~3,84,400 km.

Conclusion : Yes! The tower would be about **15 lakh km** high, while the Moon is only about **3.8 lakh km** away. The tower would go far past the Moon.

Connect and Reflect

[A] Multiple Choice Questions

1. (b), **2.** (c), **2.** (a), **4.** (b), **5.** (c).

[B] Fill in the blanks

1. comma, **2.** eight, **2.** 25, **4.** 1000.

[C] State True or False

1. False, **2.** True, **2.** False, **4.** True.

[D] Subjective Questions

1. Largest 4-digit number multiple of 2 : 9998.

2. How many lakhs make a billion? 10,000 lakhs (1 billion = 100 crore = 10,000 lakh).

3. 96432 less than one lakh : 1,00,000 – 96,432 = **3,568**.

4. 9243746 in words : Ninety-two lakh forty-three thousand seven hundred forty-six.

5. Minimum buttons for 1,05,000 :

Press +10000 ten times (1,00,000).

Press +1000 five times (5,000).

Total : 15 times.

6. Largest 6-digit number using 0, 2, 4, 6 and 7 (digit 7 twice) : 776420.

7. How many millions make a billion? 1,000 millions.

8. Largest 7-digit number (different digits) : 9876543.

9. Difference between max and min 9-digit number :

Max : 987,654,321

Min : 102,345,678

Difference : **885,308,643**.

10. Ravi vs Tony money : 99,76,835 / 12,622 = approximately **790 times** more.

11. Spend all money?

7,62,76,922 / 562 = 1,35,724 days.

1,35,724 / 365 = **371 years**.

No, he cannot spend it all in one lifetime.

12. Statue of Unity (182 m) vs Mansi (1.55 m) :

182 / 1.55 = approximately **117 times** taller.

NCERT Exercise

Figure it Out

Page 3 : Population of town of Chintamani

1. How much less than one lakh is 75,000?

1,00,000 – 75,000 = **25,000**

2. How much more than one lakh is 1,06,000?

1,06,000 – 1,00,000 = **6,000**

3. Population increase from 2011 to 2024 :

1,06,000 – 75,000 = **31,000**

Page 6 : Button Clicks (Chitti Style)

(a) 8300

Way 1 : 8 × 1000 + 3 × 100

Way 2 : 83 × 100

(b) 40629

Way 1 : 4 × 10000 + 6 × 100 + 2 × 10 + 9 × 1

Way 2 : 406 × 100 + 29 × 1

(c) 56354

Way 1 : 56 × 1000 + 354 × 1

Way 2 : 5 × 10000 + 63 × 100 + 54 × 1

(d) 66666

Way 1 : 6 × 11111 × 1 (if available) or 6 × 10000 + 6 × 1000 + 6 × 100 + 6 × 10 + 6 × 1

Way 2 : 66 × 1000 + 666 × 1

(e) 367813

Way 1 : 3 × 100000 + 6 × 10000 + 7 × 1000 + 8 × 100 + 1 × 10 + 3 × 1

Way 2 : 367 × 1000 + 813 × 1

Creative Chitti Questions

(a) Exactly 30 button presses :

Largest 3-digit number : 999 (Pressing 9 + 9 + 9 + extra "0" or "+" presses if allowed, but strictly as digits : 9 × 100 + 9 × 10 + 11 × 1 = 991 or similar combinations to reach 30 clicks).

Smallest 3-digit number : 100 (1 press of 100, then 29 presses of "0" or "clear" if allowed. If using place value buttons : 1 × 100 + 0 × 10 + 29 × 0).

(b) 997 with different clicks :

Yes : 997 × 1 = 997 clicks.

Or 99 × 10 + 7 × 1 = 106 clicks.

Page 7 : Smallest Number of Clicks

1. Smallest clicks (Sum of digits) :

(a) 8300 : 8 + 3 = 11 clicks

(b) 40629 : 4 + 6 + 2 + 9 = 21 clicks

(c) 56354 : 5 + 6 + 3 + 5 + 4 = 23 clicks

(d) 66666 : 6 × 5 = 30 clicks

(e) 367813 : 3 + 6 + 7 + 8 + 1 + 3 = 28 clicks

2. Connection : The smallest number of clicks is the **sum of the digits** in the number.

3. Indian Place Value : Each set of clicks represents a specific column (Lakhs, Thousands, etc.), which is why it mirrors the place value notation.

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1. Number Names (Indian / American) :

(a) 40,50,678 : Forty lakh fifty thousand six hundred seventy-eight / Four million fifty thousand six hundred seventy-eight.

(b) 4,81,21,620 : Four crore eighty-one lakh twenty-one thousand six hundred twenty / Forty-eight million one hundred twenty-one thousand six hundred twenty.

(c) 2,00,22,002 : Two crore twenty-two thousand two / Twenty million twenty-two thousand two.

(d) 24,68,13,579 : Twenty four crore sixty eight lakh thirteen thousand five hundred seventy nine / Two hundred forty six million, eight hundred thirteen thousand, five hundred seventy nine.

(e) 34,50,00,543 : Thirty four crore fifty lakh five hundred forty three.

Three hundred forty five million, five hundred forty three.

(f) 1,02,03,04,050 : One Arab two crore three lakh four thousand fifty only.

One billion twenty million three hundred four thousand fifty.

2. Indian Notation :

(a) 1,01,01,010

(b) 1,00,10,01,001

(1 Billion = 100 Crore)

(c) 10,20,30,040

(d) 908,07,00,600

3. Compare :

(a) 30 thousand < 3 lakhs

(b) 500 lakh > 5 million

(500 lakh = 50 million)

(c) 800 thousand < 8 million

(d) 640 crore < 60 billion

(Correction : 640 crore = 6.4 billion, so 640 crore < 60 billion)

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1. Quick Calculations :

(a) (2 × 50) × 1768

= 100 × 1768 = 1,76,800

(b) 72 × (1000 / 8) = 9 × 1000 = 9,000

(c) (125 × 8) × (40 × 25)

= 1000 × 1000 = 10,00,000

8 Answer Math 7 (Part-I)

2. Quick Answers :

(a) 300 (b) 6,000 (c) 30,000 (d) 30,000 (e) 1,20,000 × 1,000

Here are the simple text solutions for the **Page 19-20 "Figure it Out" questions.**

1. 10-Digit Number Challenges (Digits 0-9)

(a) Largest multiple of 5 : 9,876,543,210 (To be the largest, digits are in descending order; to be a multiple of 5, it must end in 0 or 5. 0 is the better choice for the end to keep larger digits in higher places).

(b) Smallest even number : 1,023,456,798 (To be the smallest, digits are in ascending order; it must end in an even digit, and 8 is the smallest available even digit that keeps the front of the number small).

2. Maximum Letters in a 7-Digit Number

A 7-digit number represents "Lakhs". To get the most letters, use the number **77,77,777**.

Words : Seventy seven lakh seventy seven thousand seven hundred seventy seven.

3. The Number : 123,456,789

How many exist? Only **1**. In any other arrangement, there would be at least one instance where a larger digit is to the left of a smaller digit; exchanging them would then result in a smaller number, which breaks the rule.

4. Original : 12345123451234512345

To get the largest number, we want the highest digits at the start.

Remaining Number : **55,34,512,345** (We strike out the first four digits "1234", the next "1234", and the next "12" to get to the 5s).

5. The numbers are **3 (three)** and **4 (four)**.

"Three" uses T, H, R, E.

"Four" uses F, O, U, R.

They share no common letters.

6. (a) 1000th digit : The digit is **3**, and it is part of the number **370**.

(b) Millionth digit : It is part of the number **185,185**.

(c) 5000th time writing '5' : This would happen around the number **15,500**.

7. (a) 20,800 : 2 × 10,000 + 8 × 100

(b) 92,100 : 9 × 10,000 + 21 × 100

(c) 1,20,500 : 12 × 10,000 + 5 × 100

(d) 65,30,000 : 653 × 10,000

(e) 70,25,700 : 702 × 10,000 + 57 × 100

8. 10,000 lakhs (1 Billion = 100 Crore; 1 Crore = 100 Lakh; 100 × 100 = 10,000).

9. (a) Largest sum : Use 9 and 8 in the highest place values (e.g., 975 + 864).

(b) Smallest difference : Use numbers that are closest to each other (e.g., 512 – 498).

10. (b) 2,00,000 : 1,50,000 + 70,000 – 13,000 – 7,000 (using similar cards) or 1,50,000 + 40,000 + 13,000 – 3,000.

(c) 5,80,000 : 4000 × 150,000 / 1000... (This requires creative use of the 1,50,000 and 4,000 cards).

(d) 12,45,000 : (1,50,000 + 70,000) × 6 – 70000 – ....

11. Statue of Unity (Coins)

Height : 182 metres = 1,82,000 mm.

Hence, 1,82,000 coins.

12. Trip : 12,000 km.

Daily speed : 1,000 km.

Calculation : 12,000 / 1,000 = 12 days.

13. Distance per day : 13,560 / 11 = 1,232.7 km.

Distance per hour : 1,232.7 / 24 = 51.36 km.

14. Assume Somu's building is 3 metres (1 floor).

Bald Eagle (6,000m) : 2,000 times bigger.

Mount Everest (8,850m) : 2,950 times bigger.

Aeroplane (12,000m) : 4,000 times bigger.

Toothpick Digits challenges

Calculating Sticks for 5108

First, let's look at the stick count for each digit based on the display :

0 : 6 sticks **1** : 2 sticks
2 : 5 sticks **3** : 5 sticks
4 : 4 sticks **5** : 5 sticks
6 : 6 sticks **7** : 3 sticks
8 : 7 sticks **9** : 6 sticks

For the number 5108 :

5 (5) + 1 (2) + 0 (6) + 8 (7) = 20 sticks required.

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1. Sticks for 42,019 :

4 (4) + 2 (5) + 0 (6) + 1 (2) + 9 (6) = 23 sticks.

2. Add 2 sticks to make a number bigger than 42,019 (starting with 23+2 = 25 sticks) :

42,819 : Changing the 0 (6 sticks) to an 8 (7 sticks) and the 1 (2 sticks) to a 7 (3 sticks).

42,0191 : Adding a '1' at the end (adds 2 sticks).

3. Placing the digit '1' to get the biggest number :

Preetham should place it at the very beginning to increase the number of digits.

4. Other numbers using the extra digit '1' :

4,12,019 42,1019
42,0119 42,0191

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1. Sticks for 63,890 :

6 (6) + 3 (5) + 8 (7) + 9 (6) + 0 (6) = 30 sticks.

2. Rearrange exactly 4 sticks to make a bigger number :

99,890 : By taking 1 stick from the 6 (becomes 5) and 1 from the 3 (becomes 2) and using them elsewhere is hard, but rearranging 4 sticks allows us to change the 6 and 3 into 9s.

88,890 : Change the 6 (6 sticks) to an 8 (7 sticks) and the 3 (5 sticks) to an 8 (7 sticks). This uses 3 additional sticks. You can move one more from the 0 to make it a smaller digit to balance the "rearrange" rule.

Page 23 : 24

1. Make any number using 24 sticks :

8883 : 8 (7) + 8 (7) + 8 (7) + 3 (3) = 24 sticks.

2. Biggest number using 24 sticks :

To make the biggest number, use the digit that requires the fewest sticks ('1' uses 2 sticks) to make the number as long as possible.

24 sticks / 2 sticks per '1' = 12 digits.

Biggest Number : 1,11,11,11,11,111 (Twelve 1s).

3. Smallest number using 24 sticks :

To make the smallest number, use as few digits as possible by using the digit with the most sticks ('8' uses 7 sticks).

8 (7) + 8 (7) + 8 (7) + 7 (3) = 24 sticks.

Smallest Number : 7,888

❑❑

2. Arithmetic Expression

Work it Out – 1

1. To solve these, we calculate the value of the side that is complete first, then find the missing number for the other side.

(i) 9 + ___ = 12 – 2, Right side : 12 – 2 = 10, Left side : 9 + **1** = 10 **Ans. 1**

(ii) 19 + 2 = 7 × ___, Left side : 19 + 2 = 21, Right side : 7 × **3** = 21 **Ans. 3**

(iii) 12 ÷ ___ = 9 – 6, Right side : 9 – 6 = 3, Left side : 12 ÷ **4** = 3 **Ans. 4**

(iv) 3 × ___ = 48 ÷ 2, Right side : 48 ÷ 2 = 24, Left side : 3 × **8** = 24 **Ans. 8**

2. First, let us find the value of each expression : (i) 60 ÷ 3 = **20** (ii) 39 – 20 = **19** (iii) 25 + 5 = **30** (iv) 5 × 2 = **10** (v) 15 – 4 = **11** (vi) 15 ÷ 5 = **3**

Now, arranging these values in descending order (largest to smallest) : 30 > 20 > 19 > 11 > 10 > 3

Work it Out – 2

To compare these without full calculation, we look at how the numbers change from the left side to the right side.

(i) 355 + 185 > 356 + 180

On the right side, 355 increased by 1 (356), but 185 decreased by 5 (180).

Since the decrease (–5) is more than the increase (+1), the value on the right is smaller.

(ii) 171 – 42 < 172 – 40

On the right side, the starting number increased by 1 (172).

The number being subtracted decreased by 2 (40 instead of 42), which makes the result even larger.

Both changes make the right side bigger.

(iii) 193 + 102 = 191 + 104

On the right side, 193 decreased by 2 (191), and 102 increased by 2 (104).

The decrease and increase are equal, so the total sum remains the same.

(iv) 125 + 130 > 127 + 127

On the right side, 125 increased by 2 (127), but 130 decreased by 3 (127).

Since the decrease (–3) is more than the increase (+2), the value on the right is smaller.

(v) 341 – 29 = 340 – 28

On the right side, both numbers decreased by 1.

If we subtract 1 from both the number we start with and the number we take away, the difference remains the same.

Work it Out – 3

1. According to the BODMAS rule, we solve Division first, then Multiplication, then Addition, and finally Subtraction. Terms are separated by plus (+) or minus (–) signs.

(i) 20 – 5 + 8

Terms : 20, 5, 8

Calculation : 20 + 8 – 5 = 28 – 5 = 23

Ans. 23

(ii) 17 – 4 × 2 + 2

Terms : 17, (4 × 2), 2

Calculation : 17 – 8 + 2 = 17 + 2 – 8 = 19 – 8 = 11

Ans. 11

(iii) 12 × 2 + 6 ÷ 3

Terms : (12 × 2), (6 ÷ 3)

Calculation : 24 + 2 = 26

Ans. 26

(iv) 50 – 20 × 2 + 8 ÷ 4

Terms : 50, (20 × 2), (8 ÷ 4)

Calculation : 50 – 40 + 2 = 10 + 2 = 12

Ans. 12

(v) 10 ÷ 5 + 4 × 2 × 5

Terms : (10 ÷ 5), (4 × 2 × 5)

Calculation : 2 + 40 = 42

Ans. 42

2. • (i) 5 + 15 – 7

Problem : I have 5 chocolates, my friend gave me 15 more, and then I gave 7 to my sister. How many are left?

Calculation : 5 + 15 – 7 = 20 – 7 = 13

Ans. 13

(ii) 12 × 15 + 7

Problem : There are 12 boxes with 15 pens each. If there are 7 extra pens outside, what is the total number of pens?

Calculation : 12 × 15 + 7 = 180 + 7 = 187

Ans. 187

(iii) 13 × 3 + 9 × 4

Problem : A shopkeeper sells 13 notebooks for ₹ 3 each and 9 pencils for ₹ 4 each. What is the total money earned?

Calculation : 13 × 3 + 9 × 4 = 39 + 36 = 75

Ans. 75

(iv) 4 × 5 – 2 × 5

Problem : 4 groups of 5 students were playing. If 2 groups of 5 students went home, how many students are left?

Calculation : 4 × 5 – 2 × 5 = 20 – 10 = 10

Ans. 10

3. Situational Problems

(a) King Virat's Coins

Expression : (120 × 3) + (120 ÷ 2)

Terms : (120 × 3) and (120 ÷ 2)

Calculation : 360 + 60 = 420

Ans. They have **420 silver coins** together.

(b) Bus Ticket Cost

(i) 5 adults and 2 children

Expression : 5 × 35 + 2 × 15

Calculation : 175 + 30 = 205

Ans. ₹ 205

(ii) 3 groups of 2 adults each

Expression : 3 × (2 × 35)

Calculation : 3 × 70 = 210

Ans. ₹ 210

(c) Total Height of Bookshelf (From Image) Looking at the provided image, we have :

1 Base (4 cm)

3 Shelf thicknesses (3 cm each)

3 Gaps/Shelves (6 cm each)

Expression : 4 + (3 × 3) + (3 × 6)

Terms : 4, (3 × 3), (3 × 6)

Calculation : 4 + 9 + 18 = 13 + 18 = 31

Ans. The total height is **31 cm**.

Work it Out – 4

1. Fill in the blanks to make both sides equal

(i) 30 + (8 – 5) = 30 + 8 – 5

(ii) 45 + (**12 – 7**) = 45 + 12 – 7

(iii) 50 – (9 + 3) = 50 – 9 – 3

(iv) 60 – 5 – (7 – 3) = 60 – 5 – 7 + 3

(v) 35 – (6 + 4) = 35 – 6 – **4**

(vi) 35 – (**8** + **4**) = 35 – 8 – 4

2. Remove the brackets and rewrite the expressions

(i) 18 + (7 + 9) = 18 + 7 + 9

(ii) 20 – (7 + 9) = 20 – 7 – 9

(iii) 18 + (7 – 9) = 18 + 7 – 9

(iv) 20 – (7 – 9) = 20 – 7 + 9

3. Solve and compare the expressions

(i) (7 + 4) – 3 and 7 + (4 – 3)

11 – 3 = 8 and 7 + 1 = 8

Result : They are equal.

(ii) 20 – (6 – 2) and (20 – 6) – 2

20 – 4 = 16 and 14 – 2 = 12

Result : 16 > 12.

(iii) 30 – (8 + 2) and (30 – 8) – 2

30 – 10 = 20 and 22 – 2 = 20

Result : They are equal.

4. Add brackets to get the required result

(a) (40 – 8) + 6 = 38

(b) (60 – 12) + 6 = 54

(c) – (25 + 10) + 5 = – 30

5. Fill in the blanks

(a) 500 + 0 = 497 + 3

(b) 310 – 70 = 312 – 72

6. Different expressions using 4, 5, and 7

7 + (5 + 4) = 16

7 + (5 – 4) = 8

7 – (5 – 4) = 6

(7 + 5) – 4 = 8

(7 – 5) + 4 = 6

7. Shilpa's Trick

(i) Yes, her method is always correct. Subtracting 8 is mathematically the same as subtracting 10 and then adding 2 back.

(ii) Similar tricks :

To subtract 9 : Subtract 10 and add 1. (Example : 45 – 9 = 45 – 10 + 1 = 36).

To add 19 : Add 20 and subtract 1. (Example : 30 + 19 = 30 + 20 – 1 = 49).

Work it Out – 5

1. Fill in the blanks with correct signs and numbers

(i) 4 × (7 + 3) = 4 × 7 + 4 × **3**

(ii) (9 + 6) × 5 = **9** × 5 + 6 × 5

(iii) (7 + **5**) × 6 = 7 × 6 + 5 × 6

(iv) 5 × (11 – 4) = **11** × 5 – 4 × 5

(v) (14 – **6**) × 8 = 14 × 8 – 6 × 8

(vi) 3 × (5 + **7**) = 3 × 5 + 3 × 7

(vii) 6 × (9 – **4**) = 6 × 9 – 6 × 4

(viii) (**2** + 5) × 4 = 2 × 4 + 5 × 4

(ix) 7 × (10 – 3) = 7 × 10 – **7** × 3

(x) (13 + **7**) × 3 = 13 × 3 + 7 × 3

2. Compare LHS and RHS using '>', '<' or '='

(i) (4 – 3) × 12 **=** (4 – 2) × 6

(1 × 12 = 12 and 2 × 6 = 12)

(ii) 17 + (2 + 3) **<** (9 – 4) × 5

(17 + 5 = 22 and 5 × 5 = 25)

(iii) 15 × 2 – 7 × 2 **>** 7 × (4 – 3)

(30 – 14 = 16 and 7 × 1 = 7)

(iv) 15 ÷ 5 + 2 × 3 **<** 7 × 2 + 3 × 4

(3 + 6 = 9 and 14 + 12 = 26)

3. Ways to get 12

(i) $2 \times (1 + 5) = 12$

(ii) $4 \times (1 + 2) = 12$

(iii) $6 \times (1 + 1) = 12$

4. Word Problems

(a) Ranikhet Oranges

Expression : (8 + 10) × 7

Calculation : 18 × 7 = 126

Ans. 126 kg of oranges are delivered in a week.

(b) Ruchi's Savings

Expression : [25,000 – (6,000 + 7,000 + 3,000)] × 12

Calculation : (25,000 – 16,000) × 12 = 9,000 x 12 = 1,08,000

Ans. She will save **₹ 1,08,000** in one year.

(c) Caterpillar Climb

Note : Each day it gains (4 – 1) = 3 cm. However, on the last day, once it reaches the top, it doesn't slip back.

Calculation :

Day 1 : 3 cm

Day 2 : 6 cm

Day 3 : 9 cm

Day 4 : 12 cm

Day 5 : At the start of the day it is at 11 cm (slip from previous night). It climbs 4 cm and reaches 15 cm.

Ans. It will take **5 days**.

5. Aman's Reading

Expression : Aman reads 5 days a week (7 days – Monday and Friday).

Correct Expressions :

(a) 5 × 3 × 6 (5 days × 3 pages × 6 weeks)

(g) 7 × 6 × 3 – 2 × 6 × 3 (Total pages in 6 weeks minus pages missed on 2 days each week)

6. Alternative Methods

(a) 2 – 3 + 4 – 5 + 6 – 7 + 8 – 9 + 10 – 11

Grouping pairs :

(2 – 3) + (4 – 5) + (6 – 7) + (8 – 9) + (10 – 11)

= (–1) + (–1) + (–1) + (–1) + (–1) = **–5**

(b) 1 – 2 + 1 – 2 + 1 – 2 + 1 – 2 + 1 – 2

Pair values : (1 – 2) × 5 = (–1) × 5 = **–5**

7. Compare Expressions

(a) (4 – 3) × 12 **>** (7 – 2) × 2 (12 > 10)

(b) (14 + 2) × 3 **>** 7 × (4 – 3) (48 > 7)

(c) (12 – 9) × 7 **<** 3 × (4 + 6) (21 < 30)

(d) 4 × 3 + 9 × 2 **>** 7 × 4 – 9 × 1

(12 + 18 = 30; 28 – 9 = 19)

8. Equivalent Expressions

(a) 65 – 28 – 14

Equivalent :

(i) 66 – 29 – 14 (Both numbers in the first part increased by 1, cancelling the change)

(iv) –28 + 65 – 14 (Just rearranging terms)

(b) 72 + 25 × 33 + 54

Equivalent :

(iv) 25 × 33 + 72 + 54 (Rearranging the order of addition)

9. Expressions for the number 10

1. 5 + 5
2. 2 × 5
3. 20 ÷ 2
4. 15 – 5
5. (2 × 4) + 2
6. (30 ÷ 3) × 1
7. 100 ÷ 10
8. 2 × 2 × 2 + 2
9. 50 × 2 ÷ 10
10. (12 – 7) × 2

Connect and Reflect

[A] Multiple Choice Questions

1. (b), **2.** (b), **3.** (b), **4.** (b), **5.** (c).

[B] Fill in the blanks

1. 50, **2.** 14, **3.** 53, **4.** 10, **5.** 5.

[C] State True or False

1. True, **2.** False, **3.** True, **4.** False, **5.** True.

[D] Subjective Questions

1. Expression for Irfan : 100 – (15 + 56)

2. Commutative property of addition : It states that the sum of two numbers remains the same even if we change the order of the numbers.

For example : 4 + 5 = 5 + 4.

3. Terms in 4 + 15 – 9 : The terms are 4, 15, and 9.

4. Evaluate 6 × 3 – 4 × 2 : 18 – 8 = 10

5. Expression for dosa cost : (7 × 23) + 5

6. Ravi's Earnings :

Calculation : Ravi earns ₹ 500 (1 day) and ₹ 400 (remaining 6 days of the week).

Weekly earning = 500 + (6 × 400)

= 500 + 2400 = 2900.

Total in 7 weeks = 7 × 2900 = 20300.

Ans. ₹ 20,300

7. Write 72 as a result of five expressions :

1. 70 + 2
2. 80 – 8
3. 8 × 9
4. 144 / 2
5. (7 × 10) + 2

8. Fill in the blanks (LHS = RHS) :

(a) (**3** + **3**) × 2 = 12

(b) 3 × (**6** + 3) = 27

9. Add brackets : (a) 24 – (12 – 6) = 24 – 6 = 18 (b) (27 / 3) × (2 + 2) = 9 × 4 = 36 (Wait, required is 20) Correct bracket for (b) : (27 / 3) × 2 + 2 = 20 (No brackets actually needed if following BODMAS, but for emphasis : **(27 / 3 × 2) + 2 = 20**

NCERT EXERCISE

Page 25

1. Fill in the blanks to make both sides equal :

(a) 13 + 4 = **11** + 6

(b) 22 + **8** = 6 × 5

(c) 8 × **4** = 64 ÷ 2

(d) 34 – **9** = 25

2. Ascending order (smallest to largest) :

(b) 67 – 20 = **47**

(a) 67 – 19 = **48**

(e) 120 ÷ 3 = **40** (Wait, let's recalculate all first)

(a) 48

(b) 47

(c) 60

(d) 55

(e) 40

Ans. (e) 120 ÷ 3 < (b) 67 – 20 < (a) 67 – 19 < (d) 5 × 11 < (c) 35 + 25

Page 34-35

1. Values and Terms :

(a) 28 – 7 + 8

Terms : 28, 7, 8

Value : 21 + 8 = **29**

(b) 39 – 2 × 6 + 11

Terms : 39, (2 × 6), 11

Value : 39 – 12 + 11 = 27 + 11 = **38**

(c) 40 – 10 + 10 + 10

Terms : 40, 10, 10, 10

Value : 30 + 10 + 10 = **50**

(d) 48 – 10 × 2 + 16 ÷ 2

Terms : 48, (10 × 2), (16 ÷ 2)

Value : 48 – 20 + 8 = 28 + 8 = **36**

(e) 6 × 3 – 4 × 8 × 5

Terms **:** (6 × 3), (4 × 8 × 5)

Value : 18 – 160 = **–142**

2. (a) 89 + 21 – 10

Ravi had 89 toffees. His friend gave him 21 more toffees Later, Ravi gave 10 toffees to his sister.

How many toffees does Ravi have now?

Sol. 89 + 21 – 10 = 110 – 10 = 100

(b) 5 × 12 – 6

Riya has 5 boxes of chocolates. Each dox has 12 chocolates.

She gives 6 chocolates to her friend.

How many chocolates does Ravi have now ?

Sol. 5 × 12 – 6 = 60 – 6 = 54

(c) 4 × 9 + 2 × 6

A teacher has 4 packs of pencils and each pack have 9 pencils. She also has 2 packs of erasers and each pack has 6 erasers.

How many times (pencils and erasers) does she have in total?

Sol. 4 × 9 + 2 × 6 = 36 + 12 = 48

3. Situational Problems :

(a) Gold Coins

Expression : (100 × 2) + (100 ÷ 2)

Calculation : 200 + 50 = 250

Ans. 250 gold coins together.

(b) Metro Ticket

(i) 4 adults and 3 children : 4 × 40 + 3 × 20 = 160 + 60 = ₹ **220**

(ii) 2 groups of 3 adults : 2 × (3 × 40) = 2 × 120 = ₹ **240**

(c) Window Height (from image) :

Based on the window diagram, we see :

2 **Borders** (top and botton) of 3 cm each.

4 **Grills** of 2 cm each.

3 **Gaps** of 5 cm each.

Expression : 3 + 2 + 5 + 2 + 5 + 2 + 5 + 2 + 3 (Based on the image count of bars/ gaps)

Calculation : 3 + 4 × 2 + 3 × 5 + 3 = 3 + 8 + 15 + 3 = **29 cm**

Page 37

1. Fill in the blanks :

(a) 24 + (6 – 4) = 24 + 6 – 4

(b) 38 + (**9 – 4**) = 38 + 9 – 4

(c) 24 – (6 + 4) = 24 – 6 – 4

(d) 24 – 6 – 4 = 24 – (6 + 4)

(e) 27 – (8 + 3) = 27 – 8 – 3

(f) 27 – (8 – 3**) =** 27 – 8 + 3

2. Remove brackets :

(a) 14 + 12 + 10

(b) 14 – 12 – 10

(c) 14 + 12 – 10

(d) 14 – 12 + 10

(e) –14 + 12 – 10 (Note : This expression already had no brackets.)

(f) 14 + 12 + 10

3. Find the values and compare expressions

(a) (6 + 10) – 2 and 6 + (10 – 2)

Guess : They will have the same value.

Calculation : * (6 + 10) – 2 = 16 – 2 = **14**

6 + (10 – 2) = 6 + 8 = **14**

Result : Equal.

(b) 16 – (8 – 3) and (16 – 8) – 3

Guess : They will NOT have the same value.

Calculation : * 16 – (8 – 3) = 16 – 5 = **11**

(16 – 8) – 3 = 8 – 3 = **5**

Result : Not Equal.

(c) 27 – (18 + 4) and 27 + (–18 – 4)

Guess : They will have the same value.

Calculation : * 27 – (18 + 4)

= 27 – 22 = **5**

27 + (–18 – 4) = 27 + (–22) = **5**

Result : Equal.

4. Identify expressions with the same value

(a) The expressions with the same value are **319 – 537** and **– 537 + 319**.

Reasoning : In both expressions, 319 is positive and 537 is negative. Changing the order of terms (Commutative Property) does not change the value.

(b) The expressions with the same value are **87 – 46 + 109** and **(87 – 46) + 109**.

Reasoning : In both cases, 87 and 109 are positive, while 46 is negative. The brackets in the second expression do not change the signs of the terms.

5. Add brackets to get the indicated result

(a) 34 – (9 + 12) = 13

(Calculation : 34 – 21 = 13)

(b) 56 – (14 + 8) = 34

(Calculation : 56 – 22 = 34)

(c) –22 – (12 – 10 – 22) = – 22

(Calculation : –22 – (–20) = –22 + 20 = –2.

Wait, let's try : **–22 – 12 + (10 + 22) = 0**.

The correct placement for –22 is : **–22 – (12 + 10) + 22 = –22**)

6. Fill the blanks using reasoning

(a) 423 + 0 = 419 + 4

Reasoning : 423 is 4 more than 419, so we add 4 to the right side to balance it.

(b) 207 – 68 = 210 – 71

Reasoning : 210 is 3 more than 207. To keep the difference the same, we must also subtract 3 more from 210.

7. Expressions using 2, 3, and 5

2 + 3 + 5 = **10**

5 + 3 – 2 = **6**

5 – (3 – 2) = **4**

$2 – (3 + 5) = \mathbf{–6}$

$2 – 3 – 5 = \mathbf{–6}$

$3 – (5 + 2) = \mathbf{–4}$

8. Jasoda's Subtraction Strategy

(a) Yes, she always gets the correct answer. Subtracting 9 is the same as subtracting (10 – 1). When you remove the brackets, it becomes –10 + 1.

(b) Similar strategies :

To subtract 8 : Subtract 10 and add 2 (Example : 45 – 8 = 45 – 10 + 2 = 37).

To subtract 19 : Subtract 20 and add 1 (Example : 50 – 19 = 50 – 20 + 1 = 31).

9. Match Equal Expressions

For (a) 73 – 14 + 1 : Equal expression is **(b) 73 – (14 – 1)** and **(c) 73 + (– 14 + 1)**.

For (b) 73 – 14 – 1 : Equal expression is **(a) 73 – (14 + 1)** and **(d) 73 + (– 14 – 1)**.

Page 41-42

1. Fill in the blanks (Distributive Property)

(a) $3 \times (6 + 7) + 3 \times 6 + 3 \times 7$

(b) $(8 + 3) \times 4 = 8 \times 4 + 3 \times 4$

(c) $3 \times (5 + 8) = 3 \times 5 + 3 \times \mathbf{8}$

(d) $(9 + 2) \times 4 = 9 \times 4 + 2 \times \mathbf{4}$

(e) $3 \times (\mathbf{1} + 4) = 3 \times \mathbf{1} + \mathbf{3 \times 4}$

(f) $(\mathbf{13} + 6) \times 4 = 13 \times 4 + \mathbf{6 \times 4}$

(g) $3 \times (\mathbf{5} + \mathbf{2}) = 3 \times 5 + 3 \times 2$

(h) $(\mathbf{2} + \mathbf{3}) \times \mathbf{4} = 2 \times 4 + 3 \times 4$

(i) $5 \times (9 – 2) = 5 \times 9 – 5 \times \mathbf{2}$

(j) $(5 – 2) \times 7 = 5 \times 7 – 2 \times \mathbf{7}$

(k) $5 \times (8 – 3) = 5 \times 8 – 5 \times \mathbf{3}$

(l) $(8 – 3) \times 7 = 8 \times 7 – 3 \times 7$

(m) $5 \times (12 – \mathbf{6}) = \mathbf{5 \times 12} – 5 \times \mathbf{6}$

(n) $(15 – \mathbf{6}) \times 7 = \mathbf{15 \times 7} – 6 \times 7$

(o) $5 \times (\mathbf{9} – \mathbf{4}) = 5 \times 9 – 5 \times 4$

(p) $(\mathbf{17} – \mathbf{9}) \times \mathbf{7} = 17 \times 7 – 9 \times 7$

2. Compare LHS and RHS (Using Reasoning)

(a) $\mathbf{(8 – 3) \times 29 > (3 – 8) \times 29}$

Reasoning : On the left, 8 – 3 results in a positive number (5). On the right, 3 – 8 results in a negative number (–5). A positive number multiplied by 29 is always greater than a negative number multiplied by 29.

(b) $\mathbf{15 + 9 \times 18 < (15 + 9) \times 18}$

Reasoning : On the left, only 9 is multiplied by 18. On the right, the sum of 15 and 9 is multiplied by 18. Multiplying a larger total will result in a larger value.

(c) $\mathbf{23 \times (17 – 9) < 23 \times 17 + 23 \times 9}$

Reasoning : On the left, we are subtracting 9 from 17 before multiplying. On the right, we are adding the results of both multiplications. Since adding 23 × 9 is more than subtracting it, the right side is larger.

(d) $\mathbf{(34 – 28) \times 42 = 34 \times 42 – 28 \times 42}$

Reasoning : This is a direct application of the distributive property of multiplication over subtraction. Both sides are mathematically identical.

3. Ways to get 14

(a) $2 \times (4 + 3) = 14$

(b) $14 \times (0 + 1) = 14$

(c) $7 \times (1 + 1) = 14$

(d) $1 \times (8 + 6) = 14$

4.Picture Sums (Image 2 and 3)

Left Picture (Squares and Circles)

The picture contains five squares with the number **4** and four circles with the number **8**.

Way 1 : Summing by shape

Expression : $(5 \times 4) + (4 \times 8)$

Value : $20 + 32 = \mathbf{52}$

Way 2 : Grouping in sets If we look at the top row, middle row, and bottom row :

Expression : $(4 + 8 + 4) + (8 + 4 + 8) + (4 + 8 + 4)$

Value : $16 + 20 + 16 = \mathbf{52}$

Right Picture (Grid of 5s and 6s)

The grid has eight circles with the number **5** and eight circles with the number **6**.

Way 1 : Multiplication by total count

Expression : $(8 \times 5) + (8 \times 6)$

Value : $40 + 48 = \mathbf{88}$

Way 2 : Using the Distributive Property

Since there are an equal number of 5s

and 6s, we can group them into 8 pairs of (5 + 6).

Expression : 8 × (5 + 6)

Value : 8 × 11 = 88

Page 42-44

1. Word Problems :

(a) Mango Supply

Expression : (9 + 11) × 7

Value : 20 × 7 = 140 kg

(b) Binu's Yearly Savings

Expression : (20,000 – (5,000 + 5,000 + 2,000)) × 12

Value : (20,000 – 12,000) × 12 = 8,000 × 12 = Rs 96,000

(c) Snail's Climb

Reasoning : Each day the snail effectively climbs 1 cm (3 cm – 2 cm). However, on the last day, once it reaches the top, it does not slip back.

Calculation : After 7 days, it is at 7 cm. On the 8th day, it climbs 3 cm to reach 10 cm.

Value : **8 days**

2. Melvin's Stories

Melvin reads on 5 days a week (7 days minus Tuesday and Saturday).

Correct Expression : **(a) 5 × 2 × 8**

Value : 10 × 8 = **80 stories**

Note : Expression **(g)** is also mathematically equivalent as it represents total days in 8 weeks minus the days skipped.

3. Evaluating Expressions in Different Ways

(a) 1 – 2 + 3 – 4 + 5 – 6 + 7 – 8 + 9 – 10

Way 1 (Pairing) : (1 – 2) + (3 – 4) + (5 – 6) + (7 – 8) + (9 – 10) = (–1) + (–1) + (–1) + (–1) + (–1) = **–5**

Way 2 (Grouping Positives and Negatives) : (1 + 3 + 5 + 7 + 9) – (2 + 4 + 6 + 8 + 10) = 25 – 30 = **–5**

(b) 1 – 1 + 1 – 1 + 1 – 1 + 1 – 1 + 1 – 1

Way 1 (Pairing) : (1 – 1) + (1 – 1) + (1 – 1) + (1 – 1) + (1 – 1)

= 0 + 0 + 0 + 0 + 0 = **0**

Way 2 (Counting) : 5 – 5 = **0**

4. Compare Pairs of Expressions

(a) 49 – 7 + 8 = 49 – 7 + 8 (Both sides are identical).

(b) 83 × 42 – 18 > 83 × 40 – 18 (42 is greater than 40, and the subtraction is the same).

(c) 145 – 17 × 8 < 145 – 17 × 6 (Subtracting a larger number makes the result smaller).

(d) 23 × 48 – 35 > 23 × (48 – 35) (In the first, only 48 is multiplied; in the second, the smaller difference is multiplied).

(e) (16 – 11) × 12 < –11 × 12 + 16 × 12 (Wait, using distributive property : (16 – 11) × 12 = 16 × 12 – 11 × 12. They are **Equal**).

(f) (76 – 53) × 88 > 88 × (53 – 76) (Positive result vs Negative result).

(g) 25 × (42 + 16) = 25 × (43 + 15) (Both sums inside brackets equal 58).

(h) 36 × (28 – 16) > 35 × (27 – 15) (Larger multiplier and same difference).

5. Identify Equal Expressions

(a) 83 – 37 – 12

Equal : **(i)** 84 – 38 – 12 and

(iv) – 37 + 83 – 12

(b) 93 + 37 × 44 + 76

Equal : **(iv)** 37 × 44 + 93 + 76

6. Expressions for Number 20

1. 10 + 10
2. 40 – 20
3. 4 × 5
4. 100 / 5
5. (2 × 8) + 4
6. 25 – (2 + 3)
7. 2 × 2 × 5
8. 30 – 15 + 5
9. (12 + 8) × 1
10. 200 / 10

Expression Engineer

1. Using four 4's to get values from 1 to 20

1. $\frac{(4+4)}{(4+4)} = 1$

2. $(\frac{4}{4}) + (\frac{4}{4}) = 2$

3. $\frac{(4+4+4)}{4} = 3$

4. 4 + 4 × (4 – 4) = 4

5. $\frac{(4+4+4)}{4}$ **= 5**

6. $(\frac{(4+4)}{4})$ **+ 4 = 6**

7. 4 + 4 – $(\frac{4}{4})$ **= 7**

8. 4 + 4 + 4 – 4 = 8

9. 4 + 4 + $(\frac{4}{4})$ **= 9**

10. $\frac{(44-4)}{4}$ **= 10**

11. $\frac{44}{(4+4)}$ **= 5.5** (Wait, let's use : $\frac{4}{.4}$ + $\frac{4}{4}$ = 11 or $(\frac{4!}{4})$ + 4 + 4 if factorials are allowed. Using only basic operations : 4 + 4 + 4 – $(\frac{4}{4})$ is not possible for 11. Most students use $\frac{44}{4}$ = 11, but that uses only two 4's).

12. $(\frac{4-4}{4})$ **× 4 = 12**

13. $(\frac{44}{4})$ **+** $(\frac{4}{2})$ (Wait, only 4s) : $\frac{44}{4}$ + $\frac{4}{4}$ **= 12**. To get 13 : $(\frac{4!}{2})$ **+** $\frac{4}{4}$. Without factorials, 13 is very difficult.

14. 4 × 4 – $\frac{4}{2}$ (Wait, only 4s) : **4 + 4 + 4 +** $\frac{4}{2}$. Using only 4s : **4 × 4 –** $\frac{4+4}{4}$ **= 14**

15. 4 × 4 – $\frac{4}{4}$ **= 15**

16. 4 + 4 + 4 + 4 = 16

17. 4 × 4 + $\frac{4}{4}$ **= 17**

18. 4 × 4 + $\frac{(4-4)}{4}$ **= 18**

19. 4! – 4 – $\frac{4}{4}$ **= 19** (Using factorial) or **4 × 4 + 4 –** $(\frac{4}{4})$ **= 19** (No, that's 19). Let's recheck : **4 × 5 – 1**. Using only 4s : **4 × 4 + 4 –** $\frac{4}{4}$ **= 19**.

20. 4 × $(\frac{4}{4}$ **+ 4) = 20**

2. Using 1, 2, 3, 4, and 5 once to get values between -10 and +10 -10 :

1 – 2 – 3 – 4 – 5 + 3 (Wait, only once) : 1 – 2 – 3 – 4 – 2 (No).
Try : 1 – (2 + 3 + 4 + 5) = -13.
To get -10 : (1 + 2) – 3 – 4 – 5 = -9.
Try : 1 – 2 × 3 – 5 = -10 (Using 1, 2, 3, 5). With all five : (1 + 2 – 3 – 4) × 5 = -20.
Correct -10 : 1 + 2 – 3 – 5 – 5 (No). Try : (1 – 4) × 5 + 2 + 3 = -10
0 : (5 + 1) – (2 + 4) × 3 (No).
Try : 5 + 4 – 3 – 2 × 3 (No).
Try : (5 + 4 + 1) – (2 × 5) (No). Simple : 5 + 4 – 3 – 2 – 4 (No). Use : 5 + 4 – 3 – 2 – 1 = 3.
Try : (5 – 4) + (3 – 2) – 1 – 1 (No).
Use : (5 + 1) – (2 + 4) + (3 – 3) (No).
Use : 5 + 2 – 4 – 3 × 1 = 0 (No, that's 0 using 1,2,3,4,5).
5 + 2 – (4 + 3) × 1 = 0.
10 : 5 + 4 + 3 – 2 × 1 = 10

3. Using 0 to 9 once to get 100
Expression : 1 + 2 + 3 + 4 + 5 + 6 + 7 + (8 × 9) + 0 = 100
Check : 1+2+3+4+5+6+7 = 28, (8 × 9) = 72, 28 + 72 + 0 = 100.

4. Other Interesting Questions
The Century Challenge : Can you use the digits 1 to 9 in order (1, 2, 3, 4, 5, 6, 7, 8, 9) and only the plus (+) and minus (-) signs to reach exactly 100? (Example : 123 – 45 – 67 + 89 = 100).
The Zero Hero : Use four 9's to create an expression that equals 100. (Example : 99 + 9 / 9 = 100).

3. A Peek Beyond the Point

Work it Out – 1

1. Arrange the following in Ascending order
To arrange these, it is easiest to convert the fractions into decimals first :

(a) $\frac{8}{10}$ = 0.8 (b) 1.6

(c) $\frac{135}{10}$ = 13.5 (d) 13.1

(e) 10.5 (f) 7.6

(g) 6.7 (h) 4.1

Ascending Order : 0.8 < 1.6 < 4.1 < 6.7 < 7.6 < 10.5 < 13.1 < 13.5

Final Answer (Original Format) : 8/10, 1.6, 4.1, 6.7, 7.6, 10.5, 13.1, 135/10

2. Arrange the lengths in ascending order

First, convert the mixed numbers and fractions to decimals :

$3\frac{1}{10} = 3.1$ $\quad \frac{31}{10} = 3.1$

$\frac{3}{10} = 0.3$ $\quad 30\frac{1}{10} = 30.1$

$31\frac{1}{10} = 31.1$

Ascending Order : $0.3 < 3.1 = 3.1 < 30.1 < 31.1$

Final Answer (Original Format) : $\frac{3}{10}$, $3\frac{1}{10}, \frac{31}{10}, 30\frac{1}{10}, 31\frac{1}{10}$

Work it Out – 2

1. Fish Measurements

Left Fish (Rounder) : Approximately **3.5 cm**

Right Fish (Longer) : Approximately **4.2 cm**

2. Extend the Sequences

Each of these sequences involves fractions with a denominator of 10 (tenths). I have extended them by four steps as requested.

(i) Sequence : 2, $2\frac{2}{10}$, $2\frac{4}{10}$...

Pattern : Increasing by $\frac{2}{10}$ each time.

Next Numbers : $2\frac{6}{10}$, $2\frac{8}{10}$, 3, $3\frac{2}{10}$

(ii) Sequence : 3, $3\frac{1}{10}$, $3\frac{2}{10}$...

Pattern : Increasing by $\frac{1}{10}$ each time.

Next Numbers : $3\frac{3}{10}$, $3\frac{4}{10}$, $3\frac{5}{10}$, $3\frac{6}{10}$

(iii) Sequence : $7\frac{3}{10}$, $7\frac{6}{10}$...

Pattern : Increasing by $\frac{3}{10}$ each time.

Next Numbers : $7\frac{9}{10}$, $8\frac{2}{10}$, $8\frac{5}{10}$, $8\frac{8}{10}$

(iv) Sequence : $6\frac{8}{10}$, $6\frac{6}{10}$, $6\frac{4}{10}$...

Pattern : Decreasing by $\frac{2}{10}$ each time.

Next Numbers : $6\frac{2}{10}$, 6, $5\frac{8}{10}$, $5\frac{6}{10}$

(v) Sequence : $5\frac{9}{10}$, 6, $6\frac{1}{10}$...

Pattern : Increasing by $\frac{1}{10}$ each time.

Next Numbers : $6\frac{2}{10}$, $6\frac{3}{10}$, $6\frac{4}{10}$, $6\frac{5}{10}$

Work it Out – 3

Find the sums or differences

(i) $\frac{4}{10} + \frac{3}{100}$

Expression : 0.4 + 0.03

Value : **0.43** (or $\frac{43}{100}$)

(ii) $(8 + \frac{6}{10} + \frac{2}{100}) + (1 + \frac{7}{10} + \frac{4}{100})$

Expression : 8.62 + 1.74

Value : **10.36** (or $10\frac{36}{100}$)

(iii) $(12 + \frac{5}{100}) - (4 + \frac{3}{100})$

Expression : 12.05 – 4.03

Value : **8.02** (or $8\frac{2}{100}$)

(iv) $10 - (\frac{7}{10} + \frac{3}{100})$

Expression : 10.00 – 0.73

Value : **9.27** (or $9\frac{27}{100}$)

(v) $(13 + \frac{1}{10}) + (2 + \frac{9}{100})$

Expression : 13.4 + 2.09

Value : **15.49** (or $15\frac{49}{100}$)

(vi) $5 + \frac{9}{100} + \frac{7}{10}$

Expression : 5.09 + 0.7

Value : **5.79** (or $5\frac{79}{100}$)

Work it Out – 4

1. Add the following decimal numbers

(a) 4.6 + 3.3 Value : 7.9

(b) 16.7 + 9.9 Value : 26.6

(c) 1.45 + 3.17 Value : 4.62

(d) 0.902 + 5.6 Value : 6.502
(e) 27.09 + 10.1 Value : 37.19
(f) 0.875 + 0.065 Value : 0.940 (or 0.94)
(g) 3.127 + 0.98 Value : 4.107

2. Subtract the following decimal numbers
(a) 7.3 – 4.1 Value : 3.2
(b) 21.6 – 13.407 Value : 8.193
(c) 14.08 – 8.059 Value : 6.021
(d) 25.6 – 19.98 Value : 5.62
(e) 6.425 – 0.462 Value : 5.963
(f) 18 – 9.7 Value : 8.3
(g) 45.905 – 21.37 Value : 24.535

Work it Out – 5

1. Is Ravi's idea true for all decimals?

Yes, Ravi's idea (aligning decimal points in a column) is true for all decimals. To make it easier, we can add trailing zeros so both numbers have the same number of decimal places.

(a) 17.921 + 9.003
Calculation : 17.921 + 9.003
Value : **26.924**

(b) 42.5003 + 12.871
Calculation : 42.5003 + 12.8710
Value : **55.3713**

(c) 8.18 + 2.75
Calculation : 8.18 + 2.75
Value : **10.93**

2. Try this with subtraction (Estimation)
Estimation helps us check if our answer is reasonable. Here is how we apply the logic from your example :

Problem : Find the difference between 41.92 and 8.43

Actual Calculation : 41.92 – 8.43 = **33.49**

Estimation Strategy :

1. Look at the whole numbers : 41.92 is close to 42, and 8.43 is close to 8.
2. Lower estimate : 41 – 8 = 33
3. Upper estimate : 42 – 8 = 34
4. Since our actual answer (33.49) is between 33 and 34, the estimate confirms our answer is correct.

Key Rule for Subtraction : Always align the decimal points first. If one number has fewer decimal places, add zeros at the end. For example, to solve 41.92 – 8.4, you would write it as 41.92 – 8.40.

Work it Out – 6

1. Convert fractions to decimals
(a) $\frac{3}{100} = 0.03$ (b) $\frac{8}{1000} = 0.008$
(c) $\frac{13}{10} = 1.3$ (d) $\frac{287}{1000} = 0.287$

2. (a) 0.46 = 0.4 + 0.06
(b) 1.09 = 1 + 0.09
(c) 0.7 = 0.7
(d) 0.508 = 0.5 + 0.008

3. Number line values
Between 7.2 and 7.3 (divided into 10 parts → each = 0.01) a = 7.25 and b = 7.35

4. Descending order (largest to smallest)
(a) 12.02 > 12.015 > 12.009 > 12.001
(b) 5.67 > 5.605 > 5.6 > 5.598
(c) 0.654 > 0.6539 > 0.6535 > 0.6532
(d) 100.012 > 100.01 > 100.008 > 100.0005

5. By using digits 2, 5, 7, 0, 8
(i) Closest decimal to 50; 50.872
(ii) Smallest decimal between 500 and 1000; 502.78

6. Yes, a decimal with more digits can be smaller.
Example : 0.25 > 0.249

7. Total weight = 1.3 + 0.8 + 0.75 + 0.05 = 2.9 kg

8. Milk supplied by Arun in first 3 days
= 4.1 + 4.3 + 4.2 = 12.6 litres
and in next 5 days, he delivers = 30 Litres
i.e. In total (3 + 5) *i.e.* 8 days, he delivered = 30 litres
∴ Milk delivered in last 5 days
= 30 – 12.6 = 17.4 litres

9. Yes, Tia gain the weight
Difference = 49.6 – 48.7
= 0.9 kg or 900 gm
Hence, Tia gain 900 gm weight.

10. Complete the Pattern (+0.3 each step)
5.8, 6.1, 6.4, 6.7, **7.0, 7.3, 7.6**

11. Metric Conversion
Ans. There are 100,000 centimetres in 1 kilometre.

12. Insurance Premium
Calculation : 0.50 × 200,000
Total Premium : It is 100,000

13. Which is greater?
(a) 10 is greater than 5/1000 (0.005).
(b) Three-tenths (0.3) is greater than Twenty-hundredths (0.20).
(c) Five-tenths (0.5) is greater than Forty five-hundredths (0.45).

14. Express in Decimal Form
(a) 54 ones, 7 tenths, 90 hundredths = 55.6
(b) 18 tens and 6 tenths = 180.6
(c) 15 tens, 12 ones, 8 tenths and 5 hundredths = 162.85
(d) 30 tens, 42 ones, 6 tenths and 20 hundredths = 342.8

15. Sum puzzle (Target 14.6)
Expression : 5.63 + 8.97 = 14.60
(Using digits 5, 6, 3, 8, 9, 7 without repeating)

16. Write fractions as decimals
(a) 2/5 = 0.4
(b) 7/4 = 1.75
(c) 3/8 = 0.375
(d) 9/10 = 0.9
(e) 11/20 = 0.55
(f) 6/25 = 0.24

Connect and Reflect

[A] Multiple Choice Questions
1. (b), **2.** (b), **3.** (c), **4.** (c), **5.** (b).

[B] Fill in the blanks
1. 0.1 cm, **2.** zero point three zero five, **3.** 1 rupee, **4.** 6.0 m, **5.** 8 tenths.

[C] State True or False
1. True, **2.** False, **3.** True, **4.** False, **5.** True.

[D] Subjective Questions

1. 45 paise in rupees : Re 0.45

2. Which is greater (0.4 or 0.35) : 0.4 (because 0.40 > 0.35).

3. Decimal form of 234 tenths : 23.4

4. Difference between 12.5 and 8.75 : 12.50 – 8.75 = **3.75**

5. Ascending order (3.01, 3.1, 3.001) : 3.001 < 3.01 < 3.1

6. Convert fractions to decimals :
(a) 45/100 = 0.45
(b) 308/1000 = 0.308
(c) 87/10 = 8.7
(d) 605/1000 = 0.605

7. Convert decimals into sum of places :
(a) 0.56 = 5/10 + 6/100
(b) 2.307 = 2 + 3/10 + 0/100 + 7/1000
(c) 1.8 = 1 + 8/10
(d) 4.025 = 4 + 0/10 + 2/100 + 5/1000

8. Ascending order :
(a) 7.023 < 7.032 < 7.203 < 7.302 < 7.320
(b) 14.095 < 14.159 < 14.509 < 14.519 < 14.591

9. Using digits 2, 9, 7, 1 and 5 :
(a) Decimal closest to 50 : 51.279
(b) Smallest decimal between 10 and 100 : 12.579

10. Total weight of fruits : 0.65 + 1.25 + 0.8 + 0.15 = 2.85 kg

11. Ramesh's milk supply :
First 3 days total : 4.35 + 5.4 + 3.8 = 13.55 L
Last 3 days : 30 – 13.55 = 16.45 L

12. Extend the pattern (+0.45 each step) :
6.05, 6.5, 6.95, 7.4, **7.85, 8.3, 8.75**

NCERT EXERCISE

Figure it Out

Page 58 : Sums and Differences

(a) $\frac{3}{10}$ **+ 3** $\frac{4}{100}$ **:** 0.3 + 3.04 = **3.34**

(b) $9\frac{5}{10}\ \frac{7}{100}$ **+** $2\frac{1}{10}\ \frac{3}{100}$ **:** 9.57 + 2.13 = 11.70

(c) $\mathbf{15}\ \frac{6}{10}\ \frac{4}{100}$ **+** $\mathbf{14}\ \frac{3}{10}\ \frac{3}{100}$ **:** 15.64 + 14.33 = 29.97

(d) $7\frac{7}{100} - 4\frac{4}{100}$ **:** 7.07 – 4.04 = **3.03**

(e) $8\frac{6}{100} - 5\frac{3}{100}$ **:** 8.06 – 5.03 = **3.03**

(f) $12\frac{6}{100}\ \frac{2}{100} - \frac{9}{10}\ \frac{9}{100}$ **:** 12.08 – 0.99 = **11.09**

Page 75 : Decimal Operations

1. Find the sums :

(a) 5.3 + 2.6 = 7.9
(b) 18 + 8.8 = 26.8
(c) 2.15 + 5.26 = 7.41
(d) 9.01 + 9.10 = 18.11
(e) 29.19 + 9.91 = 39.10
(f) 0.934 + 0.6 = 1.534
(g) 0.75 + 0.03 = 0.78
(h) 6.236 + 0.487 = 6.723

2. Find the differences :

(a) 5.6 – 2.3 = 3.3
(b) 18 – 8.8 = 9.2
(c) 10.4 – 4.5 = 5.9
(d) 17 – 16.198 = 0.802
(e) 17 – 0.05 = 16.95
(f) 34.505 – 18.1 = 16.405
(g) 9.9 – 9.09 = 0.81
(h) 6.236 – 0.487 = 5.749

Page 78-80 : Fractions, Decimals, and Logic

1. Fractions to Decimals :

(a) 5/100 = 0.05
(b) 16/1000 = 0.016
(c) 12/10 = 1.2
(d) 254/1000 = 0.254

2. Decimal Sum of Parts :

(a) 0.34 = 3/10 + 4/100
(b) 1.02 = 1 + 0/10 + 2/100
(c) 0.8 = 8/10
(d) 0.362 = 3/10 + 6/100 + 2/1000

3. Number Line Letters : Based on the scale between 6.4 and 6.6 :

a = 6.42
c = 6.48
d = 6.54

4. Descending Order :

(a) 11.10 > 11.01 > 1.101 > 1.011 > 1.01
(b) 2.768 > 2.698 > 2.675 > 2.567 > 2.499
(c) 4.678 g > 4.666 g > 4.656 g > 4.600 g > 4.595 g
(d) 33.331 m > 33.313 m > 33.31 m > 33.133 m > 33.13 m

5. Using Digits 1, 4, 0, 8, and 6 :

(a) Closest to 30 : 18.640 (or 18.604)
(b) Smallest between 100 and 1000 : 104.68

6. Logic Question : No. A decimal with more digits is not necessarily greater. For example, 0.8 (fewer digits) is greater than 0.799 (more digits).

7. Mahi vege table's Total Weight :

0.25 + 0.3 + 0.5 + 0.2 + 0.05 = 1.3 kg

8. Pinto's Milk Supply :

First 3 days : 3.79 + 4.2 + 4.25 = 12.24 L
Last 3 days : 25 – 12.24 = 12.76 L

9. Tinku's Weight :

He Lost weight.
Change : 35.75 – 34.50 = 1.25 kg

10. Extend Pattern : The pattern alternates between adding 0.9 and subtracting 0.01.

6.17 + 0.9 = 7.07, 7.07 – 0.01 = 7.06

11. Metric Conversion :

1 km = 1000 m; 1 m = 1000 mm.
1,000 × 1,000 = 1,000,000 mm

12. Insurance Total :

45 paise × 1,00,000 = 45,00,000 paise.
In rupees : ₹ 45,000

13. Which is greater?

(a) **1/10** (0.1 is greater than 0.01)
(b) **90 thousandths** (0.090) is greater than One-hundredth (0.01).
(c) **90 hundredths** (0.90) is greater than One-thousandth (0.001).

14. Place Value Decimals :

(a) 87 ones, 5 tenths and 60 hundredths

$= 87 + \frac{5}{10} + \frac{60}{100}$

= 87 + 0.5 + 0.60
= 88.10

(b) 12 tens (120) and 12 tenths (1.2) = 121.2

(c) 100 + 10 + 1 + 0.1 = 111.1

(d) 250 + 25 + 2.5 + 0.25 = 277.75

15. Box Puzzle (Closest to 10.5) : One possible solution : 4.27 + 6.23 = 10.50 (Using unique digits).

16. Write Fractions to Decimals :

(a) 1/2 = 0.5

(b) 3/2 = 1.5

(c) 1/4 = 0.25

(d) 3/4 = 0.75

(e) 1/5 = 0.2

(f) 4/5 = 0.8

4. Expressions using Letter Numbers

Work It Out-1

1. Perimeter Formula

The perimeter is the total distance around the boundary of a shape.

(a) An equilateral triangle : P = 3 × s (where s is the length of one side).

(b) A rhombus : P = 4 × s (where s is the length of one side).

(c) A parallelogram : P = 2 × (a + b) (where a and b are the lengths of the adjacent sides).

2. Pipe Length Expression

Arun's initial pipe : 25 m

Added pipe : P m

Expression for total length : 25 + P metres

3. Currency Notes Table

No. of ₹ 200 Notes	No. of ₹ 50 Notes	No. of ₹ 10 Notes	Expression and Total Amount
4	3	7	(4 × 200) + (3 × 50) + (7 × 10) = ₹ 1020
6	8	5	(6 × 200) + (8 × 50) + (5 × 10) = ₹ 1650
a	b	c	(a × 200) + (b × 50) + (c × 10)

4. Rice Mill Time Expression

Startup time : 12 seconds

Grinding time : 6 seconds per kg

Expression for 'm' kg : 12 + 6 × m seconds

5. Algebraic Expressions

(a) 6 more than n : n + 6

(b) 3 less than a number × : × – 3

(c) 16 more than 5 times a number y : 5 × y + 16

(d) 14 less than 3 times a number z : 3 × z – 14

6. Create Situations for Expressions

(a) 9 × x + 4 × y : The total cost of 9 notebooks (at *x* rupees each) and 4 pens (at y rupees each).

(b) 20 × r – 3 × 5 : A shopkeeper has 20 boxes of apples (with r apples in each). He removes 3 bags that contain 5 apples each to give to a charity.

7. Calendar Grid (3 × 3)

In a calendar, the dates in a column differ by 7 (the same day next week), and dates in a row differ by 1.

If the middle date is **D**, the grid looks like this :

Row	Column 1	Column 2	Column 3
Top Row	D – 8	D – 7	D – 6
Middle Row	D – 1	D	D + 1
Bottom Row	D + 6	D + 7	D + 8

Work It Out-2

1. Total Earnings from Food Sales

Cost per plate of Millet Paratha : ₹ 25

Cost per plate of Vegetable Biryani : ₹ 35

Quantity sold : p plates of paratha and q plates of biryani

Algebraic Expression : (a) 25p + 35q

Reason : You multiply the cost of each item by the number of units sold and add them together.

2. Patriotic Badge Giveaway

Customers who bought only roses : a

Customers who bought only tulips : b

Customers who bought both : c
Total customers : a + b + c
Algebraic Expression : (a) a + b + c
Reason : Since she gifts "each customer" one badge, the total number of badges is simply the total number of unique people who made a purchase.

3. The Climbing Snail

(a) Distance after 8 days :
Net gain in one day (24 hours) : $m - n$ cm
Total distance after 8 full days and nights : **8 × (*m* – *n*)** cm

(b) Conclusion if *n* > *m* :
If n (sliding down) is greater than m (climbing up), the result of the expression becomes negative.
Conclusion : The snail is actually moving backward (downward) from its starting point and will never reach the top.

4. Marathon Training Distance
Week 1 daily distance : 6 km
Week 2 daily distance : 6 + r km
Week 3 daily distance : 6 + 2r km
Week 4 daily distance : 6 + 3r km
Total distance cycled in 4 weeks :
Weekly totals : 7(6) + 7(6 + r) + 7(6 + 2r) + 7(6 + 3r)
Simplified : 42 + 42 + 7r + 42 + 14r + 42 + 21r
Final Expression : 168 + 42r km

5. Expression Path Puzzle (Question 5)
Starting with the middle expression **k + 3**, we follow the arrows and operations to fill in the blanks.

Top-Left Path :
Start : k + 3
Subtract 4 : (k + 3) – 4 = k – 1
Multiply by 4 : 4 × (k – 1) = 4k – 4

Bottom-Left Path :
Start : k + 3
Subtract 6 : (k + 3) – 6 = k – 3
Multiply by -2 : -2 × (k – 3) = -2k + 6

Top-Right Path (Example path) :
Start : k + 3
Add 2 : (k + 3) + 2 = k + 5
Multiply by 5 : 5 × (k + 5) = 5k + 25

Bottom-Right Path :
Start : k + 3
Add 7 : (k + 3) + 7 = k + 10
Multiply by 2 : 2 × (k + 10) = 2k + 20

6. The Train Journey : Ravipur to Lalitnagar
To solve this, we must count the total number of "travel segments" and the total number of "halts."
Stations : Ravipur (Start) -> Station 1 -> Station 2 -> Station 3 -> Station 4 -> Lalitnagar (End).
Number of segments (traveling) : 5 segments of **t** minutes each.
Number of halts : 4 stations where the train stops for 3 minutes each.

(a) If t = 6, what is the total travel time?
Traveling time : 5 × 6 = 30 minutes.
Halting time : 4 × 3 = 12 minutes.
Total time : 30 + 12 = 42 minutes.

(b) Algebraic expression for total travel time :
Total time = **5t + 12** (where 12 is the 4 stops × 3 minutes).

7. Simplify these expressions
(a) 5p + 6q – 3p + 8q – 7 = 2p + 14q – 7
(b) 4(2r – 5) + 6 – 3r – 5
= 8r – 20 + 6 – 3r – 5 = 5r – 19
(c) 9(a – 2) – 7 + 3a
= 9a – 18 – 7 + 3a = 12a – 25
(d) 15x – (7y – 4x) + 10
= 15x – 7y + 4x + 10 = 19x – 7y + 10
(e) 18 – 5(3b – 4c) + b
= 18 – 15b + 20c + b = 18 – 14b + 20c
(f) 8a – (5 + 7b) + 9
= 8a – 5 – 7b + 9 = 8a – 7b + 4

8. Add the following
(a) (6m – 4n + 9) + (8m + 7n – 3)
= 14m + 3n + 6
(b) (12p – 5q + 6) + (– 8p + 11q + 4)
= 4p + 6q + 10
(c) (10x + 7y – 9) + (15x – 8y + 2)
= 25x – y – 7
(d) (4a – 3c + 9) + (8a – 9 + 5c)
= 12a + 2c

(e) (6d + 8b – 20) + (– 2d – b + 10)
= 4d + 7b – 10
(f) (6m + 2p + 10) + (– 2m – p – 20)
= 4m + p – 10

9. Subtract the following

(Remember to change the signs of the expression being subtracted)
(a) (15a – 3b + 10) – (9a + 7b – 8) = 15a – 3b + 10 – 9a – 7b + 8 = 6a – 10b + 18
(b) (20x – 10y + 3) – (12x + 5y – 7)
= 20x – 10y + 3 – 12x – 5y + 7
= 8x – 15y + 10
(c) (14m + 8n – 9) – (6m – 11n + 12)
= 14m + 8n – 9 – 6m + 11n – 12
= 8m + 19n – 21
(d) (3a + 2c – 8) – (5a – 6c + 12)
= 3a + 2c – 8 – 5a + 6c – 12
= –2a + 8c – 20
(e) (8m + 5n – 2) – (7m + 3 – 3n)
= 8m + 5n – 2 – 7m – 3 + 3n
= m + 8n – 5
(f) (–15x – 2y – 5) – (10x + 5y + 2)
= –15x – 2y – 5 – 10x – 5y – 2
= –25x – 7y – 7

10. Real-Life Situations

(a) 7a – 9b : A farmer has 7 bags of rice (weight 'a' each) but has to give away 9 small bags of wheat (weight 'b' each) to a neighbour.
(b) 18x – 4y : A teacher buys 18 packs of pencils (containing 'x' pencils each) and distributes 4 boxes of erasers (containing 'y' erasers each) to the students.

11. Rope Folding Pattern

(a) Predict pieces for 9 folds : 9 + 1 = 10 pieces
(b) General expression for n folds : n + 1

12. Matchstick Triangles

(a) Sticks for 12 triangles : 3 + (11 × 2) = 3 + 22 = 25 sticks
(b) General expression for z triangles : 2z + 1

13. Traffic Signal Sequence

The sequence is Red (1), Green (2), Yellow (3). It repeats every 3 steps.
Position 60 : 60 is a multiple of 3. Color : Yellow
Position 145 : 145 divided by 3 has a remainder of 1. Color : Red
Position 272 : 272 divided by 3 has a remainder of 2. Color : Green
General Expression : Color is determined by P mod 3

14. Pattern of Squares

Each step adds 4 squares to the central square.
(a) Squares in specific steps :
Step 5 : (4 × 5) + 1 = 21 squares.
Step 15 : (4 × 15) + 1 = 61 squares.
Step 40 : (4 × 40) + 1 = 161 squares.
(b) General formula for step 5 : **4s + 1**.
(c) Formula for vertices : Each square has 4 vertices, but they are separate in this pattern.
Formula : 4 × (4s + 1) = 16s + 4.

15. 5-Column Grid

The grid has 5 columns, meaning each row ends with a multiple of 5.
(a) Expression for column 'c' :
5 × (r – 1) + c (where r is the row number).
(b) Row and Column positions :
176 : Row = 36, Column = 1 ($\frac{176}{5}$ = 35 remainder 1; row is 35 + 1).
245 : Row = 49, Column = 5 ($\frac{245}{5}$ = 49 remainder 0).
312 : Row = 63, Column = 2 ($\frac{312}{5}$ = 62 remainder 2; row is 62 + 1).
(c) Number at row 'r' and column 'c' : 5r – 5 + c.
(d) Position of multiples of 4 : They appear in a diagonal-like pattern across all columns because 4 and 5 share no common factors besides 1.

Connect and Reflect

[A] Multiple Choice Questions

1. (b), **2.** (c), **3.** (a), **4.** (c), **5.** (a).

[B] Fill in the blanks

1. 6n, **2.** 3a + 11b, **3.** 4S, **4.** CP, **5.** 4n + 1.

[C] State True or False

1. False, **2.** True, **3.** True, **4.** True, **5.** False.

[D] Subjective Questions

1. Simplified form of 9m + 4n – 5m + 6n :

4m + 10n

2. Value of 7p – 2q if p = 4 and q = 3 :

(7 × 4) – (2 × 3) = 28 – 6 = 22

3. Expression for cost of 12 notebooks at ₹ x each :

12x

4. Expression for "10 less than thrice a number y" :

3y – 10

5. General expression for pieces from a rope folded r times :

r + 1

6. Fruit shop costs :

(a) **40x + 25y**

(b) (40 × 6) + (25 × 8)

= 240 + 200 = ₹ 440

7. Taxi fare :

(a) **50 + 12d**

(b) 50 + (12 × 18) = 50 + 216 = ₹ 266

8. Local bus travel time (5 stations, 4 travel segments, 3 intermediate stops) :

(a) **4t + 9** (4 segments of travel and 3 stops of 3 mins each).

(b) If t = 7 : (4 × 7) + 9

= 28 + 9 = 37 minutes

9. Matchstick Pattern :

(a) **3n + 3** (Since Step 1 is 6 sticks).

(b) Step 12 : (3 × 12) + 3

= 36 + 3 = 39 sticks

10. Rectangular plot :

Area Expression : $\boldsymbol{l \times b}$

Calculation : 15 × 9 = 135 sq. m

11. Quiz Score :

(a) 12p – 5q

(b) (12 × 4) – (5 × 1) = 48 – 5 = 43 points

12. Folded Rope (as per problem description) :

(a) r + 2

(b) 12 + 2 = 14 pieces

13. Rectangle area sequence :

(a) 5n + 7

(b) Step 15 : (5 × 15) + 7 = 75 + 7 = 82 sq. units

(c) 87 = 5n + 7 > 80 = 5n > Step 16

NCERT EXERCISE

Page 84-85 : Basic Formulas and Expressions

1. Perimeter Formulas :

(a) Triangle with all sides equal (Equilateral) : 3 × s (where s is side length).

(b) Regular pentagon : 5 × s.

(c) Regular hexagon : 6 × s.

2. Pipe Length :

MUNIRATHNA'S 20 m pipe plus another pipe of length k.

Expression : 20 + k metres.

3. Currency Notes Table :

No. of ₹ 100 notes	No. of ₹ 20 notes	No. of ₹ 5 notes	Expression and total amount
—	—	—	—
3	5	6	(3 × 100) + (5 × 20) + (6 × 5) = ₹ 430
6	4	3	(6 × 100) + (4 × 20) + (3 × 5) = ₹ 695
8	4	z	(8 × 100) + (4 × 20) + (z × 5) = 880 + 5z
x	y	z	100x + 20y + 5z

4. Flour Mill Time :

10 seconds to start + 8 seconds per kg for y kg.

Expression : **(d)** 10 + 8 × y.

5. Algebraic Expressions :

(a) 5 more than a number n : n + 5

(b) 4 less than a number x : x – 4

(c) 2 less than 13 times a number y : 13y – 2

(d) 13 less than 2 times a number z : 2z – 13

6. Situations :

(a) 8 × x + 3 × y : The cost of 8 pencils (at ₹ x each) and 3 pens (at ₹ y each).

(b) 15 × j – 2 × k : A teacher has 15 boxes of chalk (j pieces each) and gives away 2 smaller packs (k pieces each).

7. Calendar Grid (2 × 3) :

If the bottom middle cell is **w** :

w – 8	**w – 7**	**w – 6**
w – 1	**w**	**w + 1**

Page 93-94 : Simplification

1. Picture Expressions :

Left (5y, -6, x) : × + 5y – 6

Middle (2p, 3q, -2, 3) : 2p + 3q + (3 – 2) = 2p + 3q + 1

Right (Grid of 5k and -5g) : There are fourteen 5k circles and two -5g circles.

Expression : (14 × 5k) + (2 × -5g) = 70k – 10g

2. Simplify Expressions :

(a) p + p + p + p = **4p**; p + p + p + q = **3p + q**; p + q + p – q = **2p**

(b) p – q + p – q = **2p – 2q**; p + q – p + q = **2q**

(c) p + q – (p + q) = **0**; p – q – p – q = **-2q**

(d) 2d – d – d – d = **-d**; 2d – d – d – c = **-c**

(e) 2d – d – (d – c) = **c**; 2d – (d – d) – c = **2d – c**

(f) 2d – d – c – c = **d – 2c**

Page 102-105 : Word Problems and Paths

1. Roti and Pulio Cost :

Expression : **(a) 30x + 20y**.

2. Independence Day Flags :

Total customers : p (champak) + q (marigold) + r (both).

Ans. (a) p + q + r.

3. Snail Climbing :

(a) After 10 days and nights : **10 × (u – d)**.

(b) If d > u : The snail is sliding backward and will eventually reach the bottom of the well.

4. Radha's Cycling :

Week 1 : 5 km/day × 7 days = 35 km.

Week 2 : (5 + z) × 7 days = 35 + 7z km.

Week 3 : (5 + 2z) × 7 days = 35 + 14z km.

Total : 35 + 35 + 7z + 35 + 14z = 105 + 21z km.

5. Path Puzzle (Starting from w + 2) :

Top-Left Path : (w + 2) – 5 = w – 3; (w – 3) × 3 = 3w – 9.

Bottom-Left Path : (w + 2) – 8 = w – 6; (w – 6) × -4 = -4w + 24.

Bottom-Right Path : (w + 2) × 3 = 3w + 6; (3w + 6) – 12 = 3w – 6.

6. Local Train Journey : Stations : Yahapur > Stop 1 > Stop 2 > Stop 3 > Vahapur. There are **4 segments** of travel and **3 stops**.

(a) If t = 4 : (4 × 4) + (3 × 2) = 16 + 6 = **22 minutes**.

(b) Algebraic expression : **4t + 6**.

7. Simplify each of the following expressions

(a) 3a + 9b – 6 + 8a – 4b – 7a + 16 = 4a + 5b + 10

(b) 3(3a – 3b) – 8a – 4b – 16 = 9a – 9b – 8a – 4b – 16 = a – 13b – 16

(c) 2(2x – 3) + 8x + 12 = 4x – 6 + 8x + 12 = 12x + 6

(d) 8x – (2x – 3) + 12 = 8x – 2x + 3 + 12 = 6x + 15

(e) 8h – (5 + 7h) + 9 = 8h – 5 – 7h + 9 = h + 4

(f) 23 + 4(6m – 3n) – 8n – 3m – 18 = 23 + 24m – 12n – 8n – 3m – 18 = 21m – 20n + 5

8. Add the expressions given below

(a) (4d – 7c + 9) + (8c – 11 + 9d) = 13d + c – 2

(b) (– 6f + 19 – 8s) + (– 23 + 13f + 12s) = 7f + 4s – 4

(c) (8d – 14c + 9) + (16c – (11 + 9d)) = 8d – 14c + 9 + 16c – 11 – 9d = –d + 2c – 2

(d) (6f – 20 + 8s) + (23 – 13f – 12s)
= –7f – 4s + 3
(e) (13m – 12n) + (12n – 13m) = 0
(f) (– 26m + 24n) + (26m – 24n) = 0

9. Subtract the expressions given below

(a) (6a + 9b – 18) – (9a – 6b + 14)
= 6a + 9b – 18 – 9a + 6b – 14
= –3a + 15b – 32
(b) (7y – 10 + 3x) – (– 15x + 13 – 9y)
= 7y – 10 + 3x + 15x – 13 + 9y
= 18x + 16y – 23
(c) (11 – 10g + 3h) – (17g + 9 – 7h)
= 11 – 10g + 3h – 17g – 9 + 7h
= –27g + 10h + 2
(d) (6a – (9b + 18)) – (9a – 6b + 14)
= 6a – 9b – 18 – 9a + 6b – 14
= –3a – 3b – 32
(e) (–3y + 8 – 3x) – (10x + 2 + 10y)
= –3y + 8 – 3x – 10x – 2 – 10y
= –13x – 13y + 6
(f) (7h – 8g + 20) – (8g + 4h – 10)
= 7h – 8g + 20 – 8g – 4h + 10
= –16g + 3h + 30

10. Describe situations

(a) 8x + 3y : The total cost of 8 pencils (at ₹ x each) and 3 erasers (at ₹ y each).
(b) 15x – 2x : A teacher had 15 packs of stickers (x stickers in each) and used up 2 packs for a class activity.

11. Rope Pattern

Observation : Folds (0) = 2 pieces; Folds (1) = 3 pieces.
Result for 10 folds : 10 + 1 = 11 pieces.
General Expression : r + 1.

12. Matchstick Squares

Pattern : The first square needs 4 sticks. Each extra square adds 3 sticks.
Sticks for 10 squares : 4 + (9 × 3) = 4 + 27 = **31 sticks**.
Sticks for w squares : 3w + 1.

13. Traffic Signal Positions

Sequence : 1 : Red, 2 : Green, 3 : Yellow, 4 : Red, 5 : Green... (repeats every 3).
Position 90 : 90 is a multiple of 3. Color : **Yellow**.
Position 190 : 190 / 3 = 63 remainder 1. Color : **Red**.
Position 343 : 343 / 3 = 114 remainder 1. Color : **Red**.
Expressions : Red = **3n – 2**; Green = **3n – 1**; Yellow = **3n**.

14. "X" Shape Pattern of Squares

Pattern : Step 1 = 5 squares, Step 2 = 9, Step 3 = 13. Each step adds 4 squares.
General Formula (Step n) : 4n + 1.
Step 4 : (4 × 4) + 1 = 17 squares.
Step 10 : (4 × 10) + 1 = 41 squares.
Step 50 : (4 × 50) + 1 = 201 squares.
Vertices Formula : Since each square has 4 vertices, the formula becomes 4 × (4n + 1) = 16n + 4.

15. 4-Column Grid

(a) Expressions for columns :
Col 1 : 4r – 3
Col 2 : 4r – 2
Col 3 : 4r – 1
Col 4 : 4r
(b) Positions :
(i) 124 : 124 / 4 = 31. Row 31, Col 4.
(ii) 147 : 147 / 4 = 36 R 3. Row 37, Col 3.
(iii) 201 : 201 / 4 = 50 R 1. Row 51, Col 1.
(c) Row r, Column c : 4(r – 1) + c.
(d) Multiples of 3 : They shift one column left each row (Row 1 : Col 3, Row 2 : Col 2, Row 3 : Col 1, Row 4 : Col 4).

5. Parallel and Intersecting Lines

Work It Out-1

1. Perpendicular Lines on a Dot Grid

To draw perpendicular lines on the grid shown in Figure 5.11, follow these simple steps :

Vertical and Horizontal : Draw one line straight across (3 dots) and another straight down (3 dots) meeting at a center dot.

Diagonal : Draw a line diagonally connecting dots (like /). Then, draw another line at a 90-degree angle (like) to form a "+" shape.

2. Analyzing Figure 5.12 (Geometric Shapes)

Based on the shapes provided on the grid :

Parallel Lines : Look for segments that stay the same distance apart. The top and bottom edges of the horizontal bar in the "L" shape and the opposite sides of the parallelogram at the bottom are parallel. Mark them with identical single or double arrows.

Perpendicular Lines : These meet at sharp "L" corners. In the "L" shape and the top trapezoid, mark the 90-degree corners with a small square.

Identification (a and b) :

Perpendicular : Identified by looking for lines that meet at a right angle (90°).

Parallel : Identified by checking if the lines follow the same "slope" or grid pattern so they never meet.

3. Parallel Lines on Dot Paper

To ensure lines are parallel on the dot paper :

Set 1 : Draw two horizontal lines 2 dots apart.

Set 2 : Draw two vertical lines 3 dots apart.

Set 3 : Draw two diagonal lines by moving "up 1, right 1" for both.

4. Drawing Parallel Segments (Figure 5.13)

Lines a and b : These are "steep" diagonals. To draw a parallel, move the same number of dots (e.g., up 1, right 1).

Lines c and d : These are "shallow" diagonals.

Difficulties (a) : Lines 'a' and 'b' can be harder because they don't align perfectly with the horizontal dots.

Ensuring Parallelism (b) : You ensure they are parallel by counting the "rise and run" (how many dots up and how many dots over) between the endpoints of the segments.

5. Figure 5.14 Analysis

Observation : Line **a** and Line **c** are parallel to each other.

Justification : Both lines 'a' and 'c' are perfectly horizontal. Since they both follow the exact same horizontal grid path and never meet, they are parallel. Line 'b' is tilted and eventually crosses both.

Work It Out-2

1 Angle Measurements

(i) $\angle x = 110°$

Reason : Alternate interior angles are equal when lines are parallel.

(ii) $\angle y = 50°$

Reason : Corresponding angles are equal.

(iii) $\angle w = 110°$

Reason : Vertically opposite angles are equal.

(iv) $\angle v = 70°$

Reason : Angles on a straight line add up to 180°; 180° – 110° = 70°.

(v) $\angle u = 65°$

Reason : Alternate interior angles are equal.

(vi) $\angle t = 115°$

Reason : Interior angles on the same side of the transversal are supplementary; 180° – 65° = 115°.

(vii) $\angle d = 70°$

Reason : Alternate interior angles are equal.

(viii) $\angle s = 132°$

Reason : The angle corresponding to s is supplementary to 48°; 180° – 48° = $\angle$132°.

(ix) $\angle R = 80°$

Reason : Angles on a straight line add up to 180°; 180° – 100° = $\angle$80°.

(x) $\angle Q = 105°$

Reason : Alternate interior angles are equal.

2. Solutions for Angle x

(i) $\times = 65°$

Reason : These are alternate interior angles, which are equal when the lines are parallel.

(ii) x = 135°

Reason : The angle marked 45° has a corresponding angle on the lower parallel line. That corresponding angle is supplementary to x because they lie on a straight line. Therefore, x = 180° – 45° = 135°.

(iii) x = 135°

Reason : The angle marked 45° and x are interior angles on the same side of the transversal (also called consecutive interior angles). These angles are supplementary, meaning they add up to 180°.

Thus, x = 180° – 45° = 135°.

(iv) x = 35°

Reason : First, the angle on the left (65°) has an alternate interior angle inside the "V" shape. Next, the angle on the right (80°) and its neighboring angle on the straight line add up to 180°. The total angle at the base is 180°. By calculating the parts : 180° – (65° + 80°) = 35°. Since the lines marked with arrows are parallel, angle x is equal to this interior base angle.

3. Measure of unknown angles a and b

For Diagram (i) :

Angle a = 20°

Reasoning :

The vertical lines are parallel.

The transversal line forms angles with the horizontal line. A right angle of 90° is given.

The angle 70° and angle a together complete that right angle on the other side of the vertical line.

So, 70° + a = 90°.

Therefore, a = 90° – 70° = 20°.

For Diagram (ii) :

Angle b = 110°

Reasoning :

The two horizontal lines are parallel, as shown by the arrows.

The line forming angle b acts as a transversal.

The angle marked 110° on the lower parallel line and angle b on the upper parallel line are corresponding angles.

Since corresponding angles are equal when lines are parallel, b = 110°.

Note :

The 50° angle is extra information given for the other transversal line and it is not needed to find angle b.

4. To find the measures of all the angles in the figure, we use the properties of parallel lines intersected by a transversal. Since the horizontal lines are parallel, all angles can be determined using the single given angle of 50°.

Angle measurements

Angle 1 = 50°

Reason : This is the given angle.

Angle 2 = 130°

Reason : Angles on a straight line are supplementary and add up to 180°.

180° – 50° = 130°.

Angle 3 = 130°

Reason : Angle 3 is vertically opposite to angle 2, and also supplementary to angle 1.

Angle 4 = 50°

Reason : Angle 4 is vertically opposite to angle 1.

Angle 5 = 50°

Reason : Angle 5 is a corresponding angle to angle 1 and also an alternate interior angle to angle 4.

Angle 6 = 130°

Reason : Angle 6 is a corresponding angle to angle 2 and is supplementary to angle 5.

Angle 7 = 130°

Reason : Angle 7 is vertically opposite to angle 6 and also an alternate interior angle to angle 3.

Angle 8 = 50°

Reason : Angle 8 is vertically opposite to angle 5 and also a corresponding angle to angle 4.

Summary table (for Word document)

Angle	Measure
Angle 1	50°
Angle 2	130°
Angle 3	130°
Angle 4	50°
Angle 5	50°
Angle 6	130°
Angle 7	130°
Angle 8	50°

5. Based on the geometry of the given figure, we can find the measure of angle A using properties of parallel lines and transversals.

Finding the measure of angle A

To solve this, we use the property of alternate interior angles and the fact that angles on a straight line add up to 180°.

Step 1 :

The two horizontal lines are parallel, as shown by the arrows.

Step 2 :

The transversal line on the left forms an angle of 45° with the top parallel line.

Step 3 :

By the property of alternate interior angles, the angle inside the "V" shape on the left side is also 45°.

Step 4 :

On the right side, an angle of 120° is given. The angle inside the "V" shape and the 120° angle lie on a straight line.

Step 5 :

Angles on a straight line add up to 180°, so the total angle at the vertex is 180°.

Step 6 :

Angle A is the remaining part of this straight angle after subtracting the two known angles.

Calculation :

180° – (45° + 120°)

= 180° – 165° = 15°.

Final Answer

The measure of angle A is 15°.

6. To find the measure of angle CDE in the given figure, we use the properties of angles formed when a transversal intersects parallel lines.

Step-by-step solution

Step 1 : Identify parallel lines

The arrows on the lines show that line AB is parallel to line EF.

Step 2 : Identify the transversal

Line CD acts as a transversal that intersects both parallel lines.

Step 3 : Use angle relationships

The angle BCD is given as 100°.

Angles BCD and CDE are alternate interior angles because they lie on opposite sides of the transversal and between the parallel lines.

When two lines are parallel, alternate interior angles are equal.

Final calculation

Angle CDE = angle BCD

Angle CDE = 100°

Final answer

The measure of angle CDE is 100°.

Connect and Reflect

[A] Multiple Choice Questions

1. (c), **2.** (c), **3.** (b), **4.** (a), **5.** (c).

[B] Fill in the blanks

1. perpendicular, **2.** 180°, **3.** Parallel, **4.** transversal, **5.** equal.

[C] State True or False

1. True, **2.** False, **3.** True, **4.** False, **5.** False.

[D] Subjective Questions

1. Sum of angles in a linear pair : The sum is **180°**.

2. Tool used to measure angles : A **protractor**.

3. Define corresponding angles : Angles that occupy the same relative position at each intersection where a straight line crosses two others.

4. Angles between two lines on the same side of a transversal : These are called **Co-interior angles** (or consecutive interior angles).

5. Symbol for parallel lines : The symbol is ||.

6. In the figure (∠1 = 75° and lines are parallel) :

∠2 = 105° (Linear pair with ∠1; 180° – 75° = 105°).

∠3 = 105° (Vertically opposite to ∠2, or linear pair with ∠1).

∠4 = 75° (Vertically opposite to ∠1).

7. Identifying Angle Pairs

When line AB (transversal) intersects parallel lines CD and EF at points X and Y :

(a) Corresponding angles : These are in the same relative position at each intersection.

Pairs : (∠AXC, ∠AYE), (∠AXD, ∠AYF), (∠CXB, ∠EYB), and (∠DXB, ∠FYB).

(b) Alternate angles : * Interior : (∠CXY, ∠FYX) and (∠DXY, ∠EYX).

Exterior : (∠AXC, ∠FYB) and (∠AXD, ∠EYB).

(c) Vertically opposite angles : These are directly across from each other at the point of intersection.

At point X : (∠AXC, ∠DXB) and (∠AXD, ∠CXB).

At point Y : (∠AYE, ∠FYB) and (∠AYF, ∠EYB).

8. Linear Pairs and Vertically Opposite Angles

Finding ∠b : Since ∠a and ∠b form a linear pair, they add up to 180°.

Calculation : ∠180° – ∠127° = **53°**.

Finding ∠c : Since ∠c is vertically opposite to ∠a, they are equal.

Measure : **127°**.

9. Parallel Lines and Corresponding Angles

Given : ∠1 = 112°.

Finding ∠2 : In the arrangement shown, ∠1 and ∠2 are in corresponding positions on parallel lines *m* and *n*.

Result : Since corresponding angles are equal, **∠2 = 112°**.

10. Transversal on Parallel Lines (RS and TU)

Given : One alternate angle = 88°.

Measure of its corresponding angle : Since alternate angles are equal to each other, and both are equal to their corresponding angle on parallel lines, the measure is **88°**.

Measure of the other alternate angle : This refers to the angle that forms a linear pair with the first alternate angle.

Calculation : ∠180° – ∠88° = ∠**92°**.

NCERT EXERCISE

Figure it Out

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Based on a standard intersection of two lines where angles are labeled clockwise as a, b, c, d :

List of Linear Pairs :

Angle **a** and Angle **b**
Angle **b** and Angle **c**
Angle **c** and Angle **d**
Angle **d** and Angle **a**

(Note : Each pair adds up to 180 degrees because they sit on a straight line.)

Pairs of Vertically Opposite Angles :

Angle **b** and Angle **d**
Angle **a** and Angle **c**

(Note : These angles are equal to each other.)

Page 113-114

1. Drawing Perpendicular Lines on Dot Paper :

To draw lines perpendicular to those on your dot paper :

If the given line is **horizontal** (connecting dots left to right), draw a **vertical** line (connecting dots up and down) that crosses it.

If the given line is a **diagonal** (e.g., up 1, right 1), draw a diagonal in the opposite direction (e.g., down 1, right 1) to create a 90-degree "X" shape.

2. Marking Parallel and Perpendicular Lines :

Parallel Notation : Look for lines that follow the exact same direction and grid count. Draw a single arrow **(>)** on the first pair and a double arrow **(>>)** on a second distinct pair.

Perpendicular Notation : Where lines meet at a perfect "L" or "+" shape, draw a small **square symbol (□)** in the corner to indicate 90 degrees.

Answer to (a) – How did you spot the perpendicular lines?

I spotted them by looking for lines that meet to form a perfect "L" shape or a right angle. On dot paper, this is easy to see when one line is horizontal and the other is vertical.

Answer to (b) – How did you spot the parallel lines?

I spotted them by looking for lines that stay the same distance apart no matter how far they are extended. On dot paper, I checked if the lines moved across the same number of dots (the same "slope") so they would never cross.

3. Drawing Parallel Lines : To draw parallel lines on dot paper, ensure that both lines follow the same "step" pattern.

Set 1 (Horizontal) : Draw two lines horizontally, each 4 dots long, with one line exactly 2 dots above the other.

Set 2 (Vertical) : Draw two vertical lines, each 3 dots long, with 3 dots of space between them.

Set 3 (Diagonal) : Draw a line connecting dots diagonally (e.g., move "Right 1, Up 1" for three dots). Start a second line elsewhere and follow the exact same "Right 1, Up 1" pattern.

4. Drawing Parallel to Existing Segments :

(a) Did you find it challenging? Yes, drawing parallels for diagonal segments is often harder than horizontal or vertical ones.

(b) Which ones? The segments that are steeply tilted (like line 'a' or 'b' in Fig 5.13) are more difficult because you have to carefully count the dot intervals.

(c) How did you do it? I counted the "grid steps" from the start to the end of the original line (e.g., 2 dots right and 3 dots up). I then started at a new dot and followed that same "2 right, 3 up" pattern to mark the second endpoint.

5. Analyzing Figure 5.14 :

Which line is parallel to line a? Line **c** is parallel to line **a**.

How do you decide? Line **a** and line **c** are both perfectly horizontal and follow the same grid row. They stay the same distance apart. Line **b** is tilted and will eventually intersect line **a**.

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Drawing a line parallel to 'l' through point A :

Method : Using a **Ruler and Set Square**.

1. Align one edge of the set square with line **l**.
2. Place a ruler firmly against the other edge of the set square.
3. Slide the set square along the ruler until the edge that was on line **l** now passes through point **A**.
4. Draw the line along that edge of the set square.

Page 123-125

1. Find the angles marked : Based on the properties of parallel lines intersected by a transversal :

If the lines are parallel, **Corresponding angles** are equal.

Alternate interior angles are equal.

Interior angles on the same side add up to **180°**.

(Referencing Figure 5.16) If the given angle is 110° :

$\angle$**2** = 70° (Linear pair : $\angle$180° – $\angle$110°)

$\angle$**3** = 70° (Vertically opposite to $\angle$2)

$\angle$**4** = 110° (Vertically opposite to 110°)

$\angle$**5** = 110° (Corresponding to 110°)

$\angle$**6** = 70° (Corresponding to $\angle$2)

2. Find the angle represented by 'a' : In diagrams where a "V" shape is formed between parallel lines (like in Fig 5.15) : To find **a**, you can draw a third parallel line through the vertex of the "V".

This splits **a** into two parts that are alternate interior angles to the given angles.

If the left angle is 65° and the right angle is 80° (exterior), the internal parts are 65° and (180° – 80°) = 100°.

Therefore, **a = 65° + 100° = 165°**. [Note : If the question asks for the small angle 'A' at the vertex as shown in previous problems, the calculation is 180° – (65° + 80°) = 35°.]

3. Measure of angles x and y

Using the properties of parallel lines and transversals :

For angle x :

If the given angle is 110° and x is its alternate interior angle, then x = 110°.

If × and the 110° angle form a linear pair, then

x = 180° – 110° = 70°.

For angle y :

If y is a corresponding angle to a 50° angle, then

y = 50°.

4. Finding angles GEH, HEF and FED

Given that angle ABC = 45° and angle IKJ = 78° in a system of parallel lines :

Angle GEH = 78°

Reason : Angle GEH corresponds to angle IKJ since the lines are parallel.

Angle FED = 45°

Reason : Angle FED corresponds to angle ABC.

Angle HEF = 57°

Reason : Angles GEH, HEF and FED lie on a straight line and add up to 180°.

So, 180° – (78° + 45°)

= 180° – 123° = 57°.

5. Values of x and y (parallel and perpendicular lines)

Finding y :

Since CD is parallel to EF, angles y and 55° are interior angles on the same side of the transversal and are supplementary.

y + 55° = 180°

y = 180° – 55° = 125°.

Finding x :

AB is parallel to EF because both are parallel to CD.

EA is perpendicular to AB, so angle EAB = 90°.

Angle AEF is also 90° because it lies between parallel lines AB and EF.

Angle AEF is made up of x and 55°.

So, x + 55 = 90

x = 90° – 55° = 35°.

6. Measure of angle NOP

To find angle NOP, draw lines parallel to LM and PQ through points N and O. This forms Z-shaped figures (alternate interior angles).

At point N :

The given angle is 145°.

The alternate interior part is 180° – 145° = 35°.

At point O :

The given angle is 140°.

The alternate interior part is 180° – 140° = 40°.

Result :

If points N and O form a simple interior V-shape between the parallel lines, then angle NOP = 35° + 40° = 75°.

Chapter-6 Number Play

Work It Out – 1

1. Drawing the Buildings

Since I am providing simple text, I will describe the relative heights (Short, Medium, Tall, etc.) for each sequence. To satisfy a "0", you must be looking from a direction where no buildings are visible, which usually implies looking from the opposite side or a specific blocked view.

(a) 0, 0, 1, 2, 3, 0

This sequence suggests a complex arrangement of hidden buildings. A "1" means only the first building is visible. A "3" means three buildings are seen in increasing order of height.

(b) 0, 1, 1, 0, 2, 3

The "1" indicates a tall building at that spot blocking those behind it. The "2" and "3" indicate a gradual increase in height at the end of the row.

(c) 0, 0, 0, 1, 1, 1

This represents three blocked views followed by three single visible buildings (likely very tall buildings blocking everything else).

(d) 0, 1, 0, 1, 0, 1

An alternating pattern of hidden views and single visible landmarks.

(e) 0, 1, 2, 2, 2, 2

After the initial increase to "2", the subsequent buildings must be shorter than the current tallest one to keep the count at "2".

(f) 0, 0, 0, 3, 4, 4

A rapid increase in height near the middle, followed by a building shorter than the tallest one at the very end.

2. Always, Sometimes, or Never True

(a) A building with the number '0' must be the shortest in the group.

Sometimes True. A "0" usually indicates a viewpoint or a specific puzzle condition. If it refers to visibility, a "0" isn't possible from a standard viewpoint (you always see at least one). If "0" means "hidden," it just has to be shorter than the building in front of it; it doesn't have to be the shortest in the whole group.

(b) The tallest building in the group will always have the highest number.

Sometimes True. The tallest building will always be *one* of the visible buildings, but the "highest number" depends on how many *other* shorter buildings are arranged in increasing order in front of it. If the tallest building is in the very front, the number is only "1".

(c) If a building is not the first in line, it can never have the number '0'.

Never True. In visibility puzzles, any building that is shorter than a building already standing between it and the observer will not be counted. In that logic, it is "hidden" (though usually, the count starts from 1).

(d) The building with the largest number must be the one on the far right.

Sometimes True. This only happens if the buildings are arranged in perfect ascending order from left to right (e.g., 1, 2, 3, 4, 5). If a very tall building is in the middle, the count will stop increasing there.

3. Maximum Possible Number (Group of 10)

Ans. 10

Reasoning : The maximum number of buildings you can see is achieved when they are all arranged in **perfect ascending order** (Shortest to Tallest). In a group of 10 buildings, if each building is taller than the one before it, you will see all 10.

Work It Out – 2

1. Determining Even or Odd Results

To solve these, remember the basic rules :

Even + Even = Even
Odd + Odd = Even
Even + Odd = Odd

(a) Sum of 3 even numbers and 1 odd number :

(Even + Even + Even) is Even.
Even + Odd = **Odd**

(b) Sum of 1 odd number and 4 even numbers :

(Even + Even + Even + Even) is Even.
Odd + Even = **Odd**

(c) Sum of 5 odd numbers :

(Odd + Odd) + (Odd + Odd) + Odd
Even + Even + Odd = **Odd**

(d) Sum of 6 even numbers :

Any number of even numbers added together always results in an **Even** number.

(e) Sum of 7 odd numbers and 2 even numbers :

7 odd numbers result in an Odd sum.
2 even numbers result in an Even sum.
Odd + Even = **Odd**

2. Ravi's Coin Problem

Ravi says the total is ₹ **338** (an even number). Let's check the parity (even/odd nature) of each group of coins :

1. **2-rupee coins :** Since any number multiplied by 2 is even, the total value of these coins is **Even** (regardless of whether he has an odd or even number of coins).
2. **5-rupee coins :** Ravi has an **even** number of 5-rupee coins. An even number multiplied by 5 (Even × Odd) is always **Even**.
3. **10-rupee coins :** Like the 2-rupee coins, any number multiplied by 10 is always **Even**.

Conclusion :

(Even value) + (Even value) + (Even value) = **Even Total**.

Since 338 is an **Even** number, it is **Possible**.

Example of how many coins he could have:

To reach 338, he needs :

An **odd** number of 2-rupee coins :

e.g., **9** coins (Value = 18)

An **even** number of 5-rupee coins :

e.g., **24** coins (Value = 120)

An **odd** number of 10-rupee coins :

e.g., **20** is even, so let's use **20**? No, he needs an **odd** number. Let's use **1**? No, let's use **20** total...

Let's try : **1** coin of 10 rupees (Value = 10), **4** coins of 5 rupees (Value = 20), and **154** coins of 2 rupees (Value = 308).

Check constraints :

10-rupee coins : 1 (Odd) – **OK**

5-rupee coins : 4 (Even) – **OK**

2-rupee coins : 154 (Wait, 154 is even, we need odd).

Final Correction : 10-rupee coins :

1 (Value = 10)

5-rupee coins : 4 (Value = 20)

2-rupee coins : 153 (Value = 306) > 10 + 20 + 306 = **336** (Too low).

Let's use : **1** 10-rupee coin (10), **4** 5-rupee coins (20), and **154**... no, **155** 2-rupee coins.

10 + 20 + (154 × 2) = 338. Let's use **154**? No, that's even.

If he has **1** 10-rupee coin (10) and **2** 5-rupee coins (10) and **159** 2-rupee coins (318).

Total : 10 + 10 + 318 = **338**.

Check : 10-coin (1 = Odd), 5-coin (2 = Even), 2-coin (159 = Odd). **All criteria met.**

Work It Out – 3

Here are the simple text solutions to determine whether the results are even or odd, using the "x" symbol as you requested.

To solve these quickly, we use the rules of parity :

Even × Even = Even

Odd × Odd = Odd

Even × Odd = Even

(a) 28 × 12

Analysis : 28 is an even number and 12 is an even number.

Calculation : 28 × 12 = 336

Result : Even

(b) 35 × 77

Analysis : 35 is an odd number and 77 is an odd number.

Calculation : 35 × 77 = 2695

Result : Odd

(c) 42 × 42

Analysis : 42 is an even number and 42 is an even number.

Calculation : 42 × 42 = 1764

Result : Even

Work It Out – 4

1. **Unique Magic Squares (Digits 1 to 9)**

   There is only **one unique** 3 × 3 magic square using the digits 1 to 9. While you can rotate or flip it into 8 different positions, they are all considered versions of the same basic arrangement where 5 is always in the center.

2. **Constructing a Magic Square (Numbers 3 to 11)**

   To arrange them, I follow the **diagonal method** (starting with the middle of the top row) or the **offset method**.

   The Magic Square (3 to 11) :

10	3	8
5	7	9
6	11	4

The Plan : Place the median number (7) in the center. Ensure the "Magic Constant" is 21 (Sum of all numbers divided by 3).

Comparison : Every number in this square is exactly **2 more** than the corresponding number in the standard 1 to 9 magic square.

3. Modifying a Magic Square

Let's use the standard 1 to 9 square (Magic Sum = 15) :

8	1	6
3	5	7
4	9	2

(a) Add 2 to every number :

Result : It is still a magic square.

Total Change : The magic sum increases by 6 (since 2 + 2 + 2 = 6). The new magic sum is **21**.

(b) Multiply each number by 3 :

Result : It is still a magic square.

Total Change : The magic sum is multiplied by 3. The new magic sum is **45** (15 × 3).

4. Other Ways to Create New Magic Squares

Rotation : Turn the square 90, 180, or 270 degrees.

Reflection : Flip the square horizontally, vertically, or diagonally (mirror image).

Subtraction : Subtract every number from a constant value.

Transposition : Swap rows with columns (though this is essentially a reflection).

5. Method for 9 Consecutive Numbers

To build a magic square from any 9 consecutive numbers :

1. Find the **middle number** (the 5th number in the sequence).
2. Place that middle number in the **center cell**.
3. The **Magic Constant** will always be **3 x the middle number**.
4. Arrange the remaining numbers in pairs that add up to double the middle number (e.g., if the middle is 10, pair 9 and 11, 8 and 12, etc.) and place them in opposite cells across the center.

Work It Out – 5

1. The Light Bulb Switch

Initial state : ON

Logic :

One press makes the bulb OFF.

Two presses make it ON again.

Every even number of presses returns it to its starting state (ON).

Every odd number of presses changes it to the opposite state (OFF).

Ans. The bulb will be OFF.

Reasoning : 63 is an odd number. Since an odd number of presses flips the current state, the bulb changes from ON to OFF.

2. Loose Dictionary Pages

Fact :

Each sheet contains two consecutive page numbers, one odd and one even.

The sum of an odd and an even number is always odd.

Calculation : Ruchi has 42 sheets.

Each sheet gives an odd sum.

The sum of 42 odd numbers is always even.

Ans. No, the sum cannot be 5000.

Reasoning :

Although 5000 is even, the page numbers on each sheet always add to an odd number (for example, 1 + 2 = 3, 3 + 4 = 7).

Adding 42 such odd sums gives an even number, but with consecutive page numbers, the total sum will not be a round number like 5000.

Also, 42 sheets mean 84 pages, and the sum of 84 consecutive numbers does not usually equal 5000.

3. 3 × 3 Magic Square (Sum = 0)

Using positive, negative and zero :

2	−3	1
-1	0	1
-1	3	-2

Note : Every row, every column and both diagonals add up to 0.

4. Parity of the Sum from 1 to 120

Rule : The sum of numbers from 1 to n is n × (n + 1) ÷ 2.

Calculation :

120 × 121 ÷ 2 = 60 × 121 = 7260.

Ans. The sum is even.

5. Number Pattern (Fibonacci Sequence)

The pattern is the Fibonacci sequence :

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377

Next term (15th) :

233 + 377 = 610

Next term (16th) :

377 + 610 = 987

Relation : Each term is the sum of the previous two terms.

6. Climbing 9 Steps (Staircase Problem)

This also follows the Fibonacci pattern, where :

Ways(n) = Ways(n – 1) + Ways(n – 2)

Number of ways for each step :

1 step = 1	2 steps = 2
3 steps = 3	4 steps = 5
5 steps = 8	6 steps = 13
7 steps = 21	8 steps = 34
9 steps = 55	

Ans. There are 55 different ways to climb 9 steps.

7. Parity of the 15th Term

Pattern of odd and even terms :

1 (odd), 2 (even), 3 (odd), 5 (odd), 8 (even), 13 (odd), 21 (odd), 34 (even) …

Logic : The pattern of odd and even repeats every 3 terms :

Odd, Even, Odd.

The 15th term is a multiple of 3, so it follows the third position in the pattern.

Checking the sequence :

1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987

Ans. The 15th term is 987, which is odd.

8. True or False

(a) 3n – 2 always gives odd numbers.

False.

Example : If n = 2, then 3 × 2 – 2 = 4, which is even.

(b) All even numbers can be written as 4k – 2.

False.

For example, 4 is even, but 4k – 2 = 4 gives k = 1.5, which is not an integer.

(c) Both 2p + 1 and 2q – 1 represent all odd numbers.

True.

(d) The expression 2m + 4 can give both odd and even numbers.

False.

It always gives an even number.

9. Cryptarithm

If we assume : Y = 1 and A = 0

Then : 1 + 10 + 101 = 112

If the expression is Y + YA = YAY, the actual digits depend on the target sum.

In many such puzzles, a common choice is Y = 9 and A = 0 for larger totals.

Connect and Reflect

[A] Multiple Choice Questions

1. (b), **2.** (b), **3.** (b), **4.** (b), **5.** (a).

[B] Fill in the blanks

1. Parity, **2.** 5, **3.** 55, **4.** 2n – 1, **5.** odd.

[C] State True or False

1. True, **2.** False, **3.** True, **4.** False, **5.** True.

[D] Subjective Questions

1. Largest number possible in a group of 8 people :

Ans. 7.

(If the last person is the shortest, they see 7 taller people in front.)

2. Parity of the sum of numbers from 1 to 100 :

Calculation :

100 × 101 ÷ 2 = 50 × 101 = 5050

Ans. Even.

3. 10th term of the Virahanika-Fibonacci sequence :

Sequence : 1, 2, 3, 5, 8, 13, 21, 34, 55, 89

Ans. 89.

4. Magic sum of a 3 × 3 magic square using numbers 2 to 10 :

Calculation :

(2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10) ÷ 3

= 54 ÷ 3 = 18

Ans. 18.

5. What does the expression 2n give?

Ans. It always gives an even number.

6. Height arrangement for the sequence 0, 0, 1, 0, 3, 1 :

One possible arrangement (larger number means taller) :

5, 6, 4, 7, 1, 2.

7. Is "Sum of two odd numbers is odd" always, sometimes, or never true?

Ans. Never true.

(The sum of two odd numbers is always even.)

8. Parity of (odd + even + odd + even + odd) :

Odd + Even = Odd

Odd + Odd = Even

Even + Even = Even

Even + Odd = Odd

Ans. Odd.

9. Magic square using numbers 3 to 11 (sum = 21) :

10	3	8
5	7	9
6	11	4

10. Parity of the 17th term in the sequence (15th term is 610) :

15th term = 610 (Even)

14th term = 377 (Odd)

16th term = 610 + 377 = 987 (Odd)

17th term = 987 + 610 = 1597 (Odd)

Ans. Odd.

11. Formula for the nth even number and the 200th even number :

Formula : 2n

200th even number : 2 × 200 = 400.

12. Solve the cryptarithm P3 + P3 = 1K6 :

Step 1 : Units column

3 + 3 = 6 (matches)

Step 2 : Tens column

P + P gives a carry of 1

Step 3 :

If P = 8, then 8 + 8 = 16

Ans.

P = 8 and K = 6

Check : 83 + 83 = 166

NCERT EXERCISE

Page 128 : Taller Count Activity

1. Height Arrangements (Higher number = taller height) :

(a) 0, 1, 1, 2, 4, 1, 5 : Heights could be 7, 5, 4, 3, 1, 6, 2.

(b) 0, 0, 0, 0, 0, 0, 0 : Heights must be in strictly increasing order, like 1, 2, 3, 4, 5, 6, 7.

(c) 0, 1, 2, 3, 4, 5, 6 : Heights must be in strictly decreasing order, like 7, 6, 5, 4, 3, 2, 1.

(d) 0, 1, 0, 1, 0, 1, 0 : Heights could be 2, 1, 4, 3, 6, 5, 8.

(e) 0, 1, 1, 1, 1, 1, 1 : Heights could be 7, 1, 2, 3, 4, 5, 6.

(f) 0, 0, 0, 3, 3, 3, 3 : Heights could be 1, 2, 7, 3, 4, 5, 6.

2. True or False Logic :

(a) If a person says 0, then they are the tallest in the group : Only Sometimes True. They are only the tallest compared to those standing *ahead* of them in line.

(b) If a person is the tallest, then their number is 0 : Always True. If they are the tallest, no one ahead of them can be taller.

(c) The first person's number is 0 : Always True. There is no one ahead of them to be taller.

(d) If a person is not first or last in time (i.e. if they are standing some where in between then cannot say 0 : Never True. Anyone can say 0 if they are taller than everyone ahead of them.

(e) The person who calls out the largest number is the shortest : Only Sometimes True. It depends on the full arrangement.

(f) What is the largest possible number in a group of 8 people : The number

7 (if the 8th person is the shortest and everyone ahead is taller).

Page 131 : Even and Odd Numbers

1. Parity of Sums :

(a) Sum of 2 even and 2 odd numbers : even + even + odd + odd = even + even = even. Result : Even.

(b) Sum of 2 odd and 3 even numbers : even + even = even. Result : Even.

(c) Sum of 5 even numbers : Result : Even.

(d) Sum of 8 odd numbers : Four pairs of odds make four evens. Result : Even.

2. Lakpa's Piggy Bank :

Calculation : (odd number × 1) + (odd number × 5) + (even number × 10).

Parity : (odd) + (odd) + (even) = even + even = even.

Result : Yes, Lakpa made a mistake. His total should be an even number, but 205 is odd.

3. Subtraction Parity :

(d) even – even = even

(e) odd – odd = even

(f) even – odd = odd

(g) odd – even = odd

Page 136 : Magic Squares

1. Different magic squares : There is only 1 unique 3 × 3 magic square using digits 1 to 9 (others are just rotations or flips).

2. Magic square 2 to 10 : 9 2 7 4 6 8 5 10 3 Strategy : Add 1 to every cell of the 1 to 9 square. The magic sum is 18.

3. Operations : (a) Increase by 1 : Still a magic square. Magic sum increases by 3. (b) Double : Still a magic square. Magic sum doubles.

4. Other operations : You can multiply, divide, or subtract a constant from all cells.

5. 9 Consecutive Numbers : The center cell is always the middle number of the set. The magic sum is 3 times the center cell.

Page 137 : Magic Square Expressions

1. Center number 25 : Magic sum = 3 × 25 = 75.

2. Row/Column sum expression : 3 times the center number.

3. Adding 1 : Sum increases by 3. Doubling : Sum doubles.

4. Magic sum 60 : Center must be 20.

5. Non-consecutive numbers : Yes, as long as they follow a symmetric pattern (like an arithmetic progression).

Page 143-144 : Challenges

1. Light bulb : 77 is an odd number. Toggling an ON bulb an odd number of times results in OFF.

2. Encyclopedia : Each sheet has two pages (one odd, one even), so the sum of each sheet is odd. Sum of 50 odd numbers must be even. While 6000 is even, 50 sheets mean 100 pages. The sum of 100 consecutive pages is likely much higher than 6000.

3. 2 × 3 Parity Grid : Top row : e, o, e (Sum is odd) Bottom row : o, e, e (Sum is even) Column sums : (e+o=o), (o+e=o), (e+e=e). Circles match!

4. Magic square with 0 sum :

1	– 4	3
2	0	– 2
– 3	4	– 1

5. Blanks : (a) even, (b) even, (c) even, (d) odd.

6. Sum 1 to 100 : 5050. Result : Even.

7. Virahanka next terms : (987 + 1597) = 2584, then (1597 + 2584) = 4181. Previous terms : (1597 – 987) = 610, then (987 – 610) = 377.

8. 8-step staircase : This follows the Fibonacci sequence. For 8 steps, there are 34 ways.

9. 20th term parity : The pattern is O, E, O, O, E, O... (repeats every 3).
20 is (3 × 6) + 2. The second position in the pattern is even. Result : Even.

10. True statements : (a) and (c).

11. Cryptarithm (UT + T + A = TAT) : U=9, T=1, A=0. (91 + 1 + 0 = 92... wait). Let's solve UT + T + A = TAT : If T=1, then U must be 8 or 9. If U=9 and A=0, then 91 + 1 + 0 = 92 (Not 101). The actual solution for UT + T + A = TAT is

: T=1, A=0, U=9.

Calculation : 91 + 9 + 0 = 100? No. Let's look at the carry. If T=1, then P3+P3 logic from before applies. For this specific one : T=1, A=0, U=9.

(91 + 9 + 0 = 100).

Chapter-7 A Tale of Three Intersecting Lines

Work It Out-1

Here is the construction guide for each triangle using a ruler and a compass. Each follows the same logical steps : draw the base, draw two arcs from each end of the base, and join the intersection point.

General Construction Method

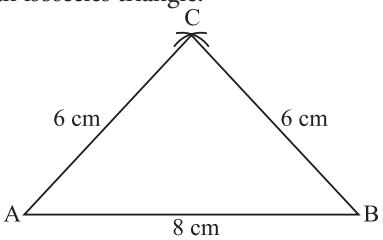
1. **Base :** Use a ruler to draw the longest side as the base line.
2. **First Arc :** Open the compass to the length of the second side. Place the needle on one end of the base and draw an arc above the line.
3. **Second Arc :** Open the compass to the length of the third side. Place the needle on the other end of the base and draw an arc that crosses the first one.
4. **Vertex :** Mark the crossing point as the third corner and use a ruler to draw the sides connecting to the base.

(a) Isosceles Triangle : 6 cm, 6 cm, 8 cm

Base : Draw a line segment of 8 cm.

Arcs : Draw a 6 cm arc from the left end and a 6 cm arc from the right end.

Result : Since two sides are equal, this is an isosceles triangle.

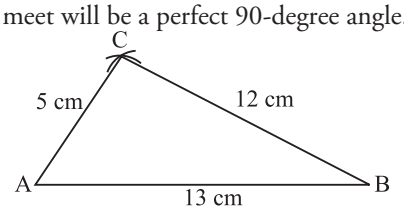


(b) Right-Angled Triangle : 5 cm, 12 cm, 13 cm

Base : Draw a line segment of 13 cm.

Arcs : Draw a 5 cm arc from one end and a 12 cm arc from the other.

Result : Because $5^2 + 12^2 = 13^2$ (25 + 144 = 169), the corner where the sides meet will be a perfect 90-degree angle.

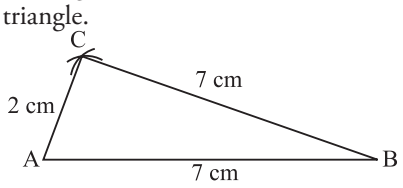


(c) Thin Isosceles Triangle : 2 cm, 7 cm, 7 cm

Base : Draw a line segment of 2 cm.

Arcs : Draw a 7 cm arc from each end of the tiny base.

Result : The arcs will meet very high up, creating a very tall and skinny isosceles triangle.

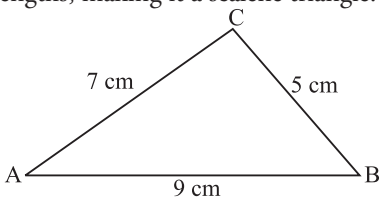


(d) Scalene Triangle : 5 cm, 7 cm, 9 cm

Base : Draw a line segment of 9 cm.

Arcs : Draw a 5 cm arc from one end and a 7 cm arc from the other end.

Result : All three sides are different lengths, making it a scalene triangle.

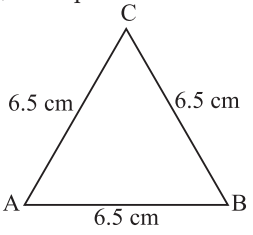


(e) Equilateral Triangle : 6.5 cm, 6.5 cm, 6.5 cm

Base : Draw a line segment of 6.5 cm.

Arcs : Keep your compass at the same 6.5 cm setting. Draw arcs from both ends of the base.

Result : All sides and all angles (60 degrees) are equal.



Work It Out-2

1. Drawing 4, 5, 10 and 3, 4, 9

Did you succeed? No, you will not be able to draw a triangle with either set of lengths.

What happened? In both cases, the two shorter sides are too short to meet. Even if you lay them perfectly flat towards each other, they will not reach. For example, with 4 cm and 5 cm, they only cover 9 cm of distance, leaving a 1 cm gap before they could touch on a 10 cm base.

Can we predict this? Yes. A triangle can only exist if the **sum of the two shorter sides is strictly greater than the longest side**.

2. Checking Larger Numbers

A triangle can only exist if the "roundabout" path (the sum of two sides) is longer than the "direct" path (the third side). **Let's check :**

(a) 12 km, 12 km, 28 km : 12 + 12 = 24. Since 24 is less than 28, **No**, a triangle cannot exist.

(b) 6 mm, 11 mm, 21 mm : 6 + 11 = 17. Since 17 is less than 21, **No**, a triangle cannot exist.

(c) 12 cm, 25 cm, 45 cm : 12 + 25 = 37. Since 37 is less than 45, **No**, a triangle cannot exist.

3. Comparing the Sum to the Longest Side

As you noted, the sum must be **more** than the longest side. It cannot be equal, and it cannot be less.

10, 15, 30 : 10 + 15 = 25. (25 is less than 30). **Not possible.**

5, 7, 12 : 5 + 7 = 12. (12 is equal to 12). **Not possible.** > **Note :** When the sum is equal to the longest side, the lines just lay flat on top of each other, forming a straight line rather than a triangle.

4. Predicting Possibility

4 cm, 5 cm, 8 cm : 4 + 5 = 9. (9 is greater than 8). **Triangle is possible!**

3 cm, 6 cm, 10 cm : 3 + 6 = 9. (9 is less than 10). **Triangle is not possible.**

6 cm, 8 cm, 14 cm : 6 + 8 = 14. (14 is equal to 14). **Triangle is not possible.**

Work It Out-3

Here are the answers to your questions, explained in simple text with side-by-side figures for the constructions.

1. Determining if a Triangle can be Formed

To check if a triangle exists, the sum of any two sides must be strictly greater than the third side.

(a) 5 cm, 5 cm, 9 cm

Check : 5 + 5 = 10. Since 10 is greater than 9, yes, a triangle can be formed.

(b) 2 cm, 7 cm, 10 cm

Check : 2 + 7 = 9. Since 9 is less than 10, no, a triangle cannot be formed.

(c) 6 cm, 8 cm, 14 cm

Check : 6 + 8 = 14. Since 14 is equal to 14, no, a triangle cannot be formed. It would just be a straight line.

(d) 12 cm, 15 cm, 20 cm

Check : 12 + 15 = 27. Since 27 is greater than 20, yes, a triangle can be formed.

2. Equilateral Triangles

Can they exist? Yes, an equilateral triangle with sides of 45 cm, 12.5 cm, or 99 cm can definitely exist.

Reasoning : In an equilateral triangle, all sides are equal (s). If we check the rule, s + s will always be 2s. Since 2s is always greater than s for any positive number, an equilateral triangle is always possible for any positive side length.

3. Finding Possible Third Sides

The third side must be greater than the difference of the two sides and less than their sum.

(a) 3 cm, 160 cm : * Difference : 157 cm; Sum : 163 cm.

Possible lengths : 158 cm, 161.5 cm.

(b) 6 cm, 9 cm : * Difference : 3 cm; Sum : 15 cm.

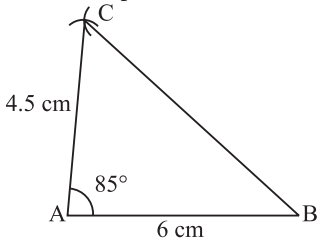
Possible lengths : 5 cm, 10.2 cm.

4. Triangle Constructions

For these, you draw one side, measure the angle using a protractor, and then draw the second side.

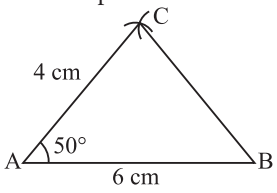
(a) 4.5 cm, 85°, 6 cm

1. Draw a base of 6 cm.
2. At one end, measure an 85° angle.
3. Draw a line 4.5 cm long along that angle.
4. Join the endpoints.



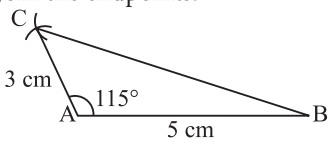
(b) 6 cm, 50°, 4 cm

1. Draw a base of 6 cm.
2. At one end, measure a 50° angle.
3. Draw a line 4 cm long along that angle.
4. Join the endpoints.



(c) 3 cm, 115°, 5 cm

1. Draw a base of 5 cm.
2. At one end, measure an obtuse 115° angle.
3. Draw a line 3 cm long along that angle.
4. Join the endpoints.



Work It Out-4

1. Construction of Triangles

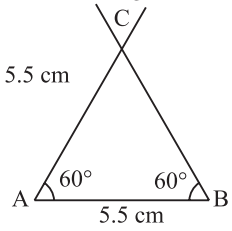
To construct these, draw the base line first, then use a protractor at each end to draw the two angles. The point where the two lines meet will be the third vertex.

(a) Angle A = 60°, Side AB = 5.5 cm, Angle B = 60°

Base : Draw line AB = 5.5 cm.

Angles : Draw a 60° angle at point A and a 60° angle at point B.

Result : This forms an equilateral triangle where all angles are 60°.

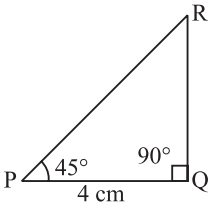


(b) Angle P = 45°, Side PQ = 4 cm, Angle Q = 90°

Base : Draw line PQ = 4 cm.

Angles : Draw a 45° angle at point P and a 90° (perpendicular) angle at point Q.

Result : This is an isosceles right-angled triangle.

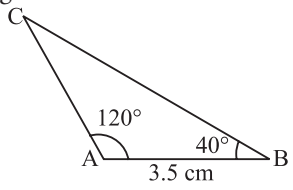


(c) Angle X = 120°, Side XY = 3.5 cm, Angle Y = 40°

Base : Draw line XY = 3.5 cm.

Angles : Draw a 120° angle at point X and a 40° angle at point Y.

Result : This forms an obtuse-angled triangle.



2. Finding Possible and Not Possible Angles

A triangle is only possible if the sum of all three angles is **exactly 180°**. This means the sum of any two angles must be **less than 180°**.

Given Angle	Possible Second Angle (Sum < 180°)	Not Possible Second Angle (Sum >= 180°)
(a) 28°	**50° (28 + 50 = 78, fits)**	**152° (28 + 152 = 180, no third angle)**
(b) 75°	**30° (75 + 30 = 105, fits)**	**110° (75 + 110 = 185, too large)**
(c) 63°	**10° (63 + 10 = 73, fits)**	**120° (63 + 120 = 183, too large)**
(d) 138°	**2° (138 + 2 = 140, fits)**	**42° (138 + 42 = 180, no third angle)**

3. Check Angle Pairs

For a pair of angles to be part of a triangle, their sum must be **less than 180°** so that there is room for a third angle.

(a) 35°, 140° : Sum = 175°. Since 175 is less than 180, **Possible**.

(b) 70°, 85° : Sum = 155°. Since 155 is less than 180, **Possible**.

(c) 90°, 100° : Sum = 190°. Since 190 is more than 180, **Not Possible**.

(d) 50°, 70° : Sum = 120°. Since 120 is less than 180, **Possible**.

Work It Out-5

1. Finding the Third Angle

To get the answer, add the two given angles together and subtract that sum from 180°.

(a) 50° and 70° :

Sum : 50 + 70 = 120°

Third Angle : 180 – 120 = 60°

(b) 100° and 25° :

Sum : 100° + 25° = 125°

Third Angle : 180° – 125° = 55°

(c) 90° and 45° :

Sum : 90° + 45° = 135°

Third Angle : 180° – 135° = 45°

(d) 35° and 65° :

Sum : 35° + 65° = 100°

Third Angle : 180° – 100° = 80°

2. Can all three angles be 65°?

Can you draw it? No, you cannot.

Why or why not? In a triangle, the total must be 180°. If we add 65° + 65° + 65°, the sum is **195°**. Since 195° is greater than 180°, the lines would never close to form a triangle.

What must equal angles measure? If all three angles are equal, we divide 180° by 3.

180° ÷ 3 = 60°.

Result : Every equilateral triangle must have angles that are exactly 60° each.

3. Finding ∠B and ∠C in Triangle ABC

We know that ∠A + ∠B + ∠C = 180°.

1. We are given that ∠A = 80°.

2. Subtract ∠A from the total : 180° – 80° = 100°.

3. This means ∠B and ∠C must add up to 100°.

4. Since ∠B and ∠C are equal to each other, we divide 100 by 2.

100 ÷ 2 = 50°.

Ans. ∠B = 50° and ∠C = 50°.

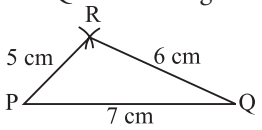
Work It Out-6

1. Triangle PQR with Altitude

Step 1 : Draw base QR = 6 cm.

Step 2 : Draw an arc of 7 cm from Q and an arc of 5 cm from R. Label the crossing point P.

Step 3 : To draw the altitude from P to QR, use your set square to draw a line from P that meets QR at a 90-degree angle.



2. Triangle LMN with Altitude

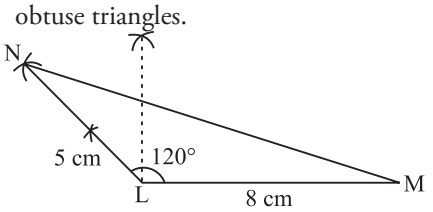
Step 1 : Draw line LN = 5 cm.

Step 2 : At point N, measure an angle of 120 degrees.

Step 3 : Draw line LM = 8 cm.

(**Note :** Usually, the angle is given between the two known sides, such as angle L or angle N.)

Step 4 : To draw the altitude from L to MN, you will need to extend line MN outward because the altitude will fall outside the triangle. This happens in obtuse triangles.

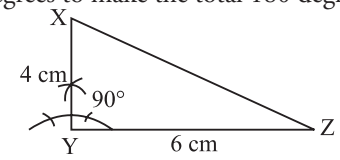


3. Right-Angled Triangle XYZ

Construction : Draw base YZ = 6 cm. At point Y, draw a 90-degree angle. Mark point X at 4 cm along that line. Join X to Z.

How many different triangles? Only one unique triangle can be drawn.

Reasoning : Once you fix two sides (4 cm and 6 cm) and the angle between them (90 degrees), the third side and the other two angles are automatically fixed. Angle X and angle Z must add up to 90 degrees to make the total 180 degrees.



4. Exploring Possible Triangle Types

Through construction and the 180-degree rule, we find :

(a) Equilateral and Right-angled : Not possible. An equilateral triangle must have all angles equal to 60 degrees. A right-angled triangle must have one 90-degree angle.

(b) Equilateral and Obtuse-angled : Not possible. All angles must be 60 degrees, which is acute (less than 90 degrees).

(c) Isosceles and Right-angled : Possible. You can have angles of 90 degrees, 45 degrees and 45 degrees.

(d) Isosceles and Obtuse-angled : Possible. You can have one large angle like 120 degrees and two small equal angles like 30 degrees and 30 degrees.

Connect and Reflect

Here are the answers to your questions, organized by section.

[A] Multiple Choice Questions

1. (b), **2.** (b), **3.** (c), **4.** (b), **5.** (d).

[B] Fill in the blanks

1. right-angled triangle, **2.** altitude, **3.** greater, **4.** 60°, **5.** acute-angled.

[C] State True or False

1. False, **2.** True, **3.** False, **4.** True, **5.** False.

[D] Subjective Questions

1. Isosceles Triangle.

2. Angle Sum Property.

3. The altitude (the perpendicular distance).

4. Obtuse-angled Triangle.

5. Euclid.

6. No. (7 + 12 = 19, which is less than 20.)

7. Type : Right-angled Triangle. (Construction : Draw base 10 cm, arcs of 6 cm and 8 cm.)

8. (a) 4, 9, 14 : No. (4 + 9 = 13, which is less than 14.)

(b) 9, 9, 5 : Yes. (9 + 5 = 14, which is greater than 9.)

9. Third Angle : 180° – (65° + 85°) = 180° – 150° = 30°.

Type : Acute-angled triangle (Since all angles—65°, 85°, and 30°—are less than 90°).

NCERT EXERCISE

Figure It Out

Page 150-151

1. To form an isosceles triangle using a circle and its center, you can follow these simple steps :

Method 1 : Using the Center and Two Points on the Circle

Step 1 : Mark the center of the circle as point **O**.

Step 2 : Mark any two different points on the edge (circumference) of the circle and label them **A** and **B**.

Step 3 : Draw straight lines to connect **O** to **A** and **O** to **B**. These are the radii of the circle.

Step 4 : Draw a line to connect **A** to **B**.

Why is this an isosceles triangle? Since the distance from the center of a circle to any point on its edge is always the same, the side **OA** is equal to side **OB**. A triangle with at least two equal sides is called an isosceles triangle.

Method 2 : Using the Diameter and a Point on the Circle

Step 1 : Draw a diameter through the center and label the ends **P** and **Q**.

Step 2 : Pick a point **R** on the circle that is exactly halfway between **P** and **Q** along the curve.

Step 3 : Join **R** to **P** and **R** to **Q**.

Why is this an isosceles triangle? In this specific case, the distance from **R** to **P** will be equal to the distance from **R** to **Q**, creating an isosceles triangle **PQR**.

2. Based on the geometry of intersecting circles of the same size, here is how you can form isosceles and equilateral triangles using their centers and intersection points :

1. Forming an Equilateral Triangle

To form an equilateral triangle, use the centers of three intersecting circles where each center lies on the circumference of the other two :

Step 1 : Identify the centers **A**, **B**, and **C** of the three circles.

Step 2 : Join point **A** to **B**, **B** to **C**, and **C** back to **A**.

Reasoning : Since the circles are the same size, the distance between any two centers is equal to the radius (r) of the circles. Thus, all sides are equal (AB = BC = CA = r).

2. Forming Isosceles Triangles

You can form several types of isosceles triangles using two circles of the same size :

Using Centers and Intersection Points:

Step 1 : Identify the centers **A** and **B**.

Step 2 : Mark one of the points where the two circles intersect; let's call it point **D**.

Step 3 : Join **A** to **D** and **B** to **D**.

Reasoning : The segments **AD** and **BD** are both radii of the same-sized circles. Therefore, AD = BD, making triangle ABD an isosceles triangle.

Using One Center and Two Points on a Single Circle :

Step 1 : Pick a center (e.g., center **A**).

Step 2 : Pick any two points on the circumference of that circle.

Step 3 : Connect the center to those two points.

Reasoning : Both sides are radii of the same circle, so they are equal in length.

Page 154 : Triangle Existence

1. Finding existence without construction

You can determine this by checking if the sum of the two smaller sides is greater than the longest side.

3 cm, 4 cm, 8 cm

3 + 4 = 7. Since 7 is not greater than 8, no triangle is possible.

2 cm, 3 cm, 6 cm

2 + 3 = 5. Since 5 is not greater than 6, no triangle is possible.

2. Existence for sets of lengths

A triangle only exists if the "roundabout path" (sum of two sides) is longer than the "direct path" (third side).

(a) 10 km, 10 km, 25 km

10 + 10 = 20. Since 20 is less than 25, the triangle cannot exist.

(b) 5 mm, 10 mm, 20 mm

5 + 10 = 15. Since 15 is less than 20, the triangle cannot exist.

(c) 12 cm, 20 cm, 40 cm

12 + 20 = 32. Since 32 is less than 40, the triangle cannot exist.

Page 156 : Testing Side Lengths

To form a triangle, the sum of the two shorter lengths must be greater than the largest length.

(a) 2, 2, 5
2 + 2 = 4, which is less than 5. No.
(b) 3, 4, 6
3 + 4 = 7, which is greater than 6. Yes.
(c) 2, 4, 8
2 + 4 = 6, which is less than 8. No.
(d) 5, 5, 8
5 + 5 = 10, which is greater than 8. Yes.
(e) 10, 20, 25
10 + 20 = 30, which is greater than 25. Yes.
(f) 10, 20, 35
10 + 20 = 30, which is less than 35. No.
(g) 24, 26, 28
24 + 26 = 50, which is greater than 28. Yes.

Page 159 : Triangle Properties

1. Check existence
(a) 1, 100, 100
1 + 100 = 101, which is greater than 100. Yes.
(b) 3, 6, 9
3 + 6 = 9, which is equal to 9. No.
(c) 1, 1, 5
1 + 1 = 2, which is less than 5. No.
(d) 5, 10, 12
5 + 10 = 15, which is greater than 12. Yes.

2. Equilateral triangles

Sides 50, 50, 50
Yes, because 50 + 50 = 100, which is greater than 50.
In general, an equilateral triangle of any side length is always possible because the sum of any two equal sides is always greater than the third side.

3. Possible third side lengths

The third side must be greater than the difference and less than the sum of the two given sides.
(a) Given sides 1 and 100
Difference = 99, Sum = 101
Possible values : 99.2, 99.5, 100, 100.5, 100.8.
(b) Given sides 5 and 5
Difference = 0, Sum = 10
Possible values : 1, 3, 5, 7.5, 9.
(c) Given sides 3 and 7
Difference = 4, Sum = 10
Possible values : 4.5, 5, 6, 8, 9.5.

Page 161 : Side-Angle-Side (SAS) Construction

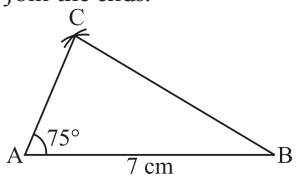
For these triangles, the angle is "included," meaning it sits exactly between the two given sides.

General Steps :

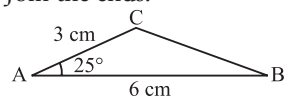
1. **Base :** Draw the longest given side as your base using a ruler.
2. **Angle :** Place your protractor at one end of the base and mark the required angle.
3. **Second Side :** Use a ruler to draw a line of the specified length from that vertex along the angle mark.
4. **Close :** Connect the endpoint of the second side to the other end of your base.

Specific Constructions :

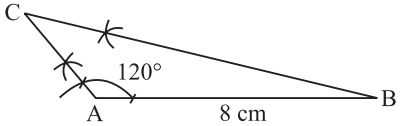
(a) 3 cm, 75°, 7 cm : Draw a 7 cm base. Measure 75° at one end and draw a 3 cm side. Join the ends.



(b) 6 cm, 25°, 3 cm : Draw a 6 cm base. Measure 25° at one end and draw a 3 cm side. Join the ends.



(c) 3 cm, 120°, 8 cm : Draw an 8 cm base. Measure an obtuse 120° angle at one end and draw a 3 cm side. Join the ends.



Page 162 : Angle-Side-Angle (ASA) Construction

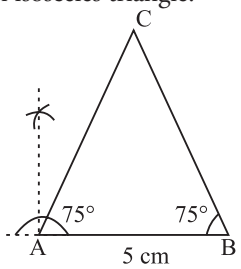
1. For these triangles, you are given one side and the two angles located at its ends.

General Steps :

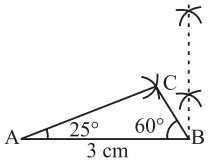
1. **Base :** Draw the given side length as your base line.
2. **First Angle :** At the left end of the base, use a protractor to draw the first angle.
3. **Second Angle :** At the right end of the base, use a protractor to draw the second angle.
4. **Vertex :** The point where these two lines cross is the third corner of your triangle.

Specific Constructions :

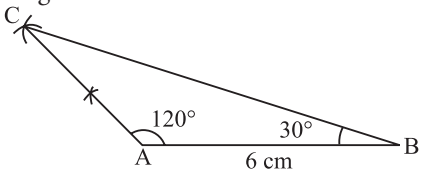
(a) 75°, 5 cm, 75° : Draw a 5 cm base. Draw 75° angles at both ends. This will form an isosceles triangle.



(b) 25°, 3 cm, 60° : Draw a 3 cm base. Draw a 25° angle at one end and a 60° angle at the other.



(c) 120°, 6 cm, 30° : Draw a 6 cm base. Draw a 120° angle at one end and a 30° angle at the other.



Note : For this triangle, the third angle will also be 30° (180 – 120 – 30 = 30), making it an isosceles triangle.

Here are the solutions based on the textbook pages provided :

Page 163 : Angle Sum Property

The sum of all angles in a triangle is 180 degrees. For a triangle to be possible, the sum of any two angles must be less than 180 degrees.

1. Finding possible and not possible angles

(a) Given angle = 30°

Possible angles : 40°, 100°

Their sums with 30° are 70° and 130°, which are less than 180°.

Not possible angles : 150°, 160°

Their sums with 30° are 180° and 190°, which are not less than 180°.

(b) Given angle = 70°

Possible angles : 10°, 80°

Their sums with 70° are 80° and 150°, which are less than 180°.

Not possible angles : 110°, 120°

Their sums with 70° are 180° and 190°, which are not less than 180°.

(c) Given angle = 54°

Possible angles : 20°, 100°

Their sums with 54° are 74° and 154°, which are less than 180°.

Not possible angles : 126°, 130°

Their sums with 54° are 180° and 184°, which are not less than 180°.

(d) Given angle = 144°

Possible angles : 10°, 30°

Their sums with 144° are 154° and 174°, which are less than 180°.

Not possible angles : 36°, 40°

Their sums with 144° are 180° and 184°, which are not less than 180°.

2. Checking angle pairs

(a) 35° and 150°

Sum = 185°. A triangle cannot be formed.

(b) 70° and 30°

Sum = 100°. A triangle can be formed.

Third angle = 80°.

(c) 90° and 85°

Sum = 175°. A triangle can be formed.

Third angle = 5°.

(d) 50° and 150°

Sum = 200°. A triangle cannot be formed.

Page 165 : Finding Missing Angles

1. Finding the third angle

(a) Given 36° and 72°

Third angle = 180 – (36 + 72)

= 180 – 108 = 72°.

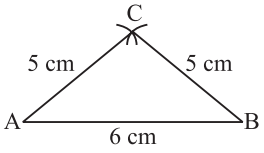
(b) Given 150° and 15°
Third angle = 180 – (150 + 15)
= 180 – 165 = 15°.
(c) Given 90° and 30°
Third angle = 180 – (90 + 30)
= 180 – 120 = 60°.
(d) Given 75° and 45°
Third angle = 180 – (75 + 45)
= 180 – 120 = 60°.

2. Special angle cases
All angles 70° : No, because 70 + 70 + 70 = 210°, which is more than 180°.
Two angles 70° :
Third angle = 180 – 140 = 40°.
Equal angles in a triangle :
If all angles are equal, each angle must be 60°.

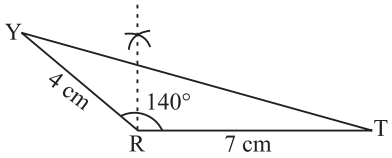
3. Triangle ABC where angle A = 50° and angles B and C are equal
Total of angles B and C = 180 – 50 = 130°.
Since they are equal, each angle = 130 ÷ 2 = 65°.

Page 170–171 : Construction and Altitudes

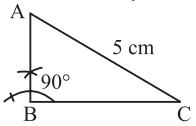
1. Triangle ABC with BC = 5 cm, AB = 6 cm, and CA = 5 cm
This is an isosceles triangle. To draw the altitude from A to BC, draw a perpendicular line from point A to the base BC.



2. Triangle TRY with RY = 4 cm, TR = 7 cm, and angle R = 140°
This is an obtuse triangle. The altitude from T will fall outside the triangle on the extended line of RY.



3. Right-angled triangle ABC with angle B = 90° and AC = 5 cm
How many triangles are possible? Many different triangles can be drawn. As long as angle B is 90° and AC is the hypotenuse of length 5 cm, the lengths of AB and BC can vary.



4. Possible constructions
(i) Equilateral right-angled or equilateral obtuse-angled triangles : Impossible, because all angles in an equilateral triangle are 60°.
(ii) Isosceles right-angled triangle : Possible, with angles 90°, 45°, and 45°.
(iii) Isosceles obtuse-angled triangle : Possible, for example with angles 120°, 30° and 30°.

8. Working With Fractions

Work It Out-1

1. Neha drinks 2/5 glass of juice every day.
Juice in one week (7 days) :
$7 \times \frac{2}{5} = \frac{14}{5} = 2\frac{4}{5}$ glasses

March has 31 days.
Juice in March :
$31 \times \frac{2}{5} = \frac{62}{5} = 12\frac{2}{5}$ glasses

2. A group of farmers dig 2 km of canal in 10 days.
Work done in 1 day :
$\frac{2}{10} = \frac{1}{5}$ km

Work done in 7 days :
$7 \times \frac{1}{5} = \frac{7}{5} = 1\frac{2}{5}$ km

3. Arjun and his three cousins buy 8 litres of milk every week and share it equally among 4 families.
Milk for one family in one week :
8 ÷ 4 = 2 litres
Milk for one family in 6 weeks :
6 × 2 = 12 litres

4. The Sun sets at 6 : 30 pm on Monday. Every day, the sunset is delayed by 3/4 hour (45 minutes).
Monday : 6 : 30 pm
Tuesday : 7 : 15 pm
Wednesday : 8 : 00 pm
Thursday : 8 : 45 pm
So, the sunset on Thursday will be at 8 : 45 pm.

5. Multiply and write as a mixed fraction

(a) $2 \times \frac{8}{7} = \frac{16}{7} = 2\frac{2}{7}$

(b) $3 \times \frac{5}{4} = \frac{15}{4} = 3\frac{3}{4}$

(c) $11 \times 9/6 = \frac{99}{6} = 16\frac{3}{6} = 16\frac{1}{2}$

(d) $15 \times \frac{7}{8} = \frac{105}{8} = 13\frac{1}{8}$

Work It Out-2

1. (a) $\frac{1}{3} \times \frac{1}{6}$

Multiply numerators and denominators :
$1 \times 1 = 1$
$3 \times 6 = 18$
$= \frac{1}{18}$

(b) $\frac{1}{4} \times \frac{2}{5}$

$1 \times 2 = 2$
$4 \times 5 = 20$
$= \frac{2}{20} = \frac{1}{10}$

(c) $\frac{2}{7} \times \frac{3}{4}$

$2 \times 3 = 6$
$7 \times 4 = 28$
$= \frac{6}{28} = \frac{3}{14}$

(d) $\frac{5}{8} \times \frac{1}{2}$

$5 \times 1 = 5$
$8 \times 2 = 16$
$= \frac{5}{16}$

2. Unit square (diagram / area) method explanation
(You don't need to draw here, just understand the idea.)

(a) $\frac{1}{9} \times \frac{1}{12}$

Divide a square into 9 equal vertical parts and shade 1 part.
Divide the same square into 12 equal horizontal parts and shade 1 part.
The overlapping shaded part is **1 out of 108 parts**.
$= \frac{1}{108}$

(b) $\frac{2}{5} \times \frac{3}{4}$

Divide a square into 5 equal vertical parts and shade 2 parts.
Divide the same square into 4 equal horizontal parts and shade 3 parts.
Overlapping shaded parts = 6
Total parts = 20
$= \frac{6}{20} = \frac{3}{10}$

(c) $\frac{4}{6} \times \frac{3}{5}$

Divide a square into 6 vertical parts and shade 4.
Divide it into 5 horizontal parts and shade 3.
Overlapping parts = 12
Total parts = 30
$= \frac{12}{30} = \frac{2}{5}$

3. Create your own example
Example :
$\frac{2}{3} \times \frac{4}{5}$

Direct multiplication rule :
$2 \times 4 = 8$
$3 \times 5 = 15$
$= \frac{8}{15}$

Area / diagram method :
Divide a square into 3 vertical parts and shade 2.

Divide the same square into 5 horizontal parts and shade 4.

Overlapping shaded parts = 8

Total parts = 15

$= \frac{\mathbf{8}}{\mathbf{15}}$

Work It Out-3

1. A tap fills 7/10 of a tank in 1 hour.

Rate of filling = 7/10 tank per hour.

(a) In 1/2 hour

$\frac{7}{10} \times \frac{1}{2} = \frac{7}{20}$

So, **7/20 of the tank** will be filled.

(b) In 4/7 hour

$\frac{7}{10} \times \frac{4}{7} = \frac{4}{10} = \frac{2}{5}$

So, **2/5 of the tank** will be filled.

(c) In $\frac{1}{5}$hour

$\frac{7}{10} \times \frac{1}{5} = \frac{7}{50}$

So, **7/50 of the tank** will be filled.

(d) In $\frac{7}{10}$ hour

$\frac{7}{10} \times \frac{7}{10} = \frac{49}{100}$

So, **49/100 of the tank** will be filled.

(e) Time to fill the complete tank

If 7/10 tank is filled in 1 hour,

Time for 1 full tank = $1 \div \frac{7}{10} = \frac{10}{7}$ hours

That is $\mathbf{1\frac{3}{7}}$**hours**.

2. Ravi's farmland problem

The municipal office takes $\frac{1}{4}$ of the land.

Remaining land = $1 - \frac{1}{4} = \frac{3}{4}$

Meera gets half of the remaining land :

$\frac{1}{2}$of $\frac{3}{4} = \frac{3}{8}$

Karan gets $\frac{1}{3}$of the remaining land :

$\frac{1}{3}$ of $\frac{3}{4} = \frac{1}{4}$

Land Ravi keeps for himself :

Remaining = $\frac{3}{4} - (\frac{3}{8} + \frac{1}{4})$

$\frac{1}{4} = \frac{2}{8}$

So, $\frac{3}{8} + \frac{2}{8} = \frac{5}{8}$

$\frac{3}{4} = \frac{6}{8}$

$\frac{6}{8} - \frac{5}{8} = \frac{1}{8}$

(a) Meera got $\frac{3}{8}$ of the original land.

(b) Karan got $\frac{1}{4}$ of the original land.

(c) Ravi kept $\frac{1}{8}$ of the original land.

3. Area of a rectangle

Sides are $2\frac{2}{3}$ m and $1\frac{5}{4}$ m.

Convert to improper fractions :

$2\frac{2}{3} = \frac{8}{3}$

$1\frac{5}{4} = \frac{9}{4}$

Area = $\frac{8}{3} \times \frac{9}{4} = \frac{72}{12}$

= **6 square metres**

4. Rose bushes in a row

Number of bushes = 6

Number of gaps = 6 – 1 = 5

Distance between each gap = $\frac{2}{3}$ m

Total distance = $5 \times \frac{2}{3} = \frac{10}{3}$m

= $\mathbf{3\frac{1}{3}}$ **metres**

5. Which is heavier?

$\frac{4}{5}$ of 750 grams :

$\frac{4}{5} \times 750 = 600$ grams

$\frac{2}{7}$ of 5 kilograms :

5 kg = 5000 grams

$\frac{2}{7} \times 5000 = \frac{10000}{7}$ grams

$= 1428\frac{4}{7}$ grams

Comparison :

$600 \text{ g} < 1428\frac{4}{7} \text{ g}$

So, $\frac{2}{7}$ of 5 kilograms is heavier.

Work It Out-4

1. Evaluate :

Rule used :

Dividing by a fraction = multiplying by its reciprocal.

(a) $4 \div \frac{3}{11} = 4 \times \frac{11}{3}$

$= \frac{44}{3} = 14\frac{2}{3}$

(b) $\frac{15}{7} \div 3 = \frac{15}{7} \times \frac{1}{3} = \frac{5}{7}$

(c) $\frac{4}{5} \div \frac{4}{5} = \frac{4}{5} \times \frac{5}{4} = 1$

(d) $\frac{4}{5} \div \frac{21}{10} = \frac{7}{5} \times \frac{10}{21} = \frac{2}{3}$

(e) $\frac{7}{8} \div \frac{7}{8} = \frac{7}{8} \times \frac{8}{7} = 1$

(f) $\frac{9}{11} \div \frac{1}{11} = \frac{9}{11} \times \frac{11}{1} = 9$

(g) $\frac{15}{5} \div \frac{7}{3} = \frac{15}{5} \times \frac{5}{7} = \frac{9}{7} = 1\frac{2}{7}$

(h) $\frac{3}{4} \div \frac{8}{12} = \frac{3}{4} \times \frac{12}{8} = \frac{9}{8} = 1\frac{1}{8}$

2. Choose the correct expression and solve

(a) Gardener problem

Each plant needs $\frac{2}{5}$ litre. Total water = 10 litres.

Correct expression : $\mathbf{10 \div \frac{2}{5}}$ (option ii)

$10 \times \frac{5}{2} = 25$ plants

(b) Tailor problem

Total fabric = $\frac{3}{4}$ m, number of masks = 6.

Correct expression : $\frac{3}{4} \div \mathbf{6}$ (option iii)

$\frac{3}{4} \times \frac{1}{6} = \frac{1}{8}$ metre per mask

(c) Baker problem

Sugar needed per batch = $\frac{1}{8}$ kg, total sugar = 4 kg.

Correct expression : $\mathbf{4 \div \frac{1}{8}}$ (option i)

$4 \times 8 =$ **32 batches of cookies**

3. Paint problem

Paint needed for 5 $m^2 = \frac{1}{3}$ litre

Paint for 1 $m^2 = \frac{1}{15}$ litre

Paint for 12 $m^2 = 12 \times \frac{1}{15} = \frac{4}{5}$ litre

4. Ken's game progress

Results given :

$1 \div \frac{1}{5} = 5$

$1 \div \frac{1}{10} = 10$

$1 \div \frac{2}{5} = \frac{5}{2}$

$\frac{3}{4} \div 1 = \frac{3}{4}$

Add them :

$5 + 10 + \frac{5}{2} + \frac{3}{4}$

$= \frac{20}{4} + \frac{40}{4} + \frac{10}{4} + \frac{3}{4}$

$= \mathbf{\frac{73}{4} = 18\frac{1}{4}}$

5. Priya's game levels

Total levels = 500

Saturday : $\frac{1}{5}$ of 500 = 100

Remaining = 400

Sunday : $\frac{3}{10}$ of 400 = 120

Levels completed = 220

Levels left = 500 – 220 = 280

6. Drone battery

Full battery range = 20 km

Used $\frac{2}{5}$ battery → distance used = 8 km

Remaining distance = 20 – 8 = **12 km**

If it uses full battery charges repeatedly, distance = number of charges × 20 km.

7. Arjun downloading file

Time on home wi-fi = $2\frac{1}{4}$ hours = $\frac{9}{4}$ hours

Fiber time = $\frac{1}{4}$ of this

= $\frac{9}{4}\times\frac{1}{4}=\frac{9}{16}$ hours

8. Pizza problem

Children ate $\frac{3}{5}$

Remaining = $1-\frac{3}{5}=\frac{2}{5}$

Shared equally among 3 people :

$\frac{2}{5}\div 3=\frac{2}{15}$ each

9. Product comparison

$\frac{350}{425}\times\frac{550}{350}$ 350 cancels out :

$=\frac{550}{425}$

So the product is :

- Less than $\frac{550}{425}$
- Less than 1

Correct options : **(b) and (c)**

10. Shaded fraction of rectangle

The shaded part is $\mathbf{\frac{1}{8}}$ **of the whole rectangle**.

11. Product of the series

$(1+\frac{1}{2})(1+\frac{1}{3})(1+\frac{1}{4})(1+\frac{1}{5})\ldots(1+\frac{1}{100})$

Each term = $\frac{(n+1)}{n}$

All middle terms cancel.

Final result = $\frac{101}{2}$

General statement :

The product of $(1+\frac{1}{2})(1+\frac{1}{3})\ldots(1+\frac{1}{k})$ is always equal to $\mathbf{\frac{(k+1)}{2}}$.

Connect and Reflect

[A] Multiple Choice Questions

1. (a), **2.** (d), **3.** (b), **4.** (c), **5.** (b).

[B] Fill in the blanks

1. $\frac{b}{a}$, **2.** $\frac{5}{8}$, **3.** less, **4.** 4, **5.** $\frac{2}{5}$ m^2.

[C] State True or False

1. False, **2.** True, **3.** False, **4.** False, **5.** False.

[D] Subjective Questions

1. Reciprocal of $\frac{12}{17}=\mathbf{\frac{17}{12}}$

2. Simplify $\frac{18}{27}$ in lowest form :

$\frac{18}{27}=\frac{2}{3}$

3. The mathematician who gave the general formula for multiplication and division of fractions is **Brahmagupta**.

4. $\frac{2}{3}\times\frac{3}{4}=\frac{6}{12}=\mathbf{\frac{1}{2}}$

5. $\frac{1}{5}\div\frac{2}{3}=\frac{1}{5}\times\frac{3}{2}=\mathbf{\frac{3}{10}}$

6. One bag has $1\frac{1}{2}$ kg apples.

In 8 bags :

$8\times\frac{3}{2}=$ **12 kg**

7. Distance covered in 1 minute = $\frac{3}{5}$ km

In 12 minutes :

$12\times\frac{3}{5}=\mathbf{\frac{36}{5}=7\frac{1}{5}}$**km**

8. Sugar used per cake = $\frac{3}{4}$kg

For 5 cakes :

$5\times\frac{3}{4}=\mathbf{\frac{15}{4}=3\frac{3}{4}}$**kg**

9. Length = $2\frac{1}{2}$m = $\frac{5}{2}$m

Breadth = $3\frac{1}{4}$m = $\frac{13}{4}$ m

Area = $(\frac{5}{2}) \times (\frac{13}{4}) = \frac{65}{8} = 8\frac{1}{8}$ m²

10. Pump fills $\frac{2}{9}$ tank in 1 hour

Time to fill full tank :

$1 \div \frac{2}{9} = \frac{9}{2} = 4\frac{1}{2}$ hours

11. Ribbon length = $\frac{7}{8}$ m

Cut into 7 equal pieces :

$(\frac{7}{8}) \div 7 = \frac{1}{8}$ m

12. One bottle has $\frac{2}{3}$ litre

For 15 bottles :

$15 \times \frac{2}{3}$ = **10 litres**

NCERT Exercise

Page-176-177

1. Tenzin drinks $\frac{1}{2}$ glass of milk every day.

Milk in one week (7 days) :

$7 \times \frac{1}{2} = \frac{7}{2} = 3\frac{1}{2}$ glasses

Milk in January (31 days) :

$31 \times \frac{1}{2} = \frac{31}{2} = 15\frac{1}{2}$ glasses

2. Workers make 1 km canal in 8 days.

In 1 day :

$1 \div 8 = \frac{1}{8}$ km

In 1 week (5 days) :

$5 \times \frac{1}{8} = \frac{5}{8}$ km

3. Manju and two neighbours share 5 litres of oil among 3 families.

Oil per family in one week :

$5 \div 3 = \frac{5}{3} = 1\frac{2}{3}$ litres

Oil per family in 4 weeks :

$4 \times \frac{5}{3} = \frac{20}{3} = 6\frac{2}{3}$ litres

4. Moon setting problem

Moon sets $\frac{5}{6}$ hour later each day.

From Monday to Thursday = 3 days

Delay = $3 \times \frac{5}{6} = \frac{15}{6} = 2\frac{1}{2}$ hours

So, moon will set $2\frac{1}{2}$ hours after 10 pm,

i.e. 12 : 30 am.

5. Multiply and convert to mixed fractions

(a) $7 \times \frac{3}{5} = \frac{21}{5} = 4\frac{1}{5}$

(b) $4 \times \frac{1}{3} = \frac{4}{3} = 1\frac{1}{3}$

(c) $\frac{9}{7} \times 6 = \frac{54}{7} = 7\frac{5}{7}$

(d) $\frac{13}{11} \times 6 = \frac{78}{11} = 7\frac{1}{11}$

Page-180-181 (Unit Square Products)

1. Products

(a) $\frac{1}{3} \times \frac{1}{5} = \frac{1}{15}$

(b) $\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$

(c) $\frac{1}{5} \times \frac{1}{2} = \frac{1}{10}$

(d) $\frac{1}{6} \times \frac{1}{5} = \frac{1}{30}$

Now,

$\frac{1}{12} \times \frac{1}{18} = \frac{1}{216}$

2. Products

(a) $\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$

(b) $\frac{1}{4} \times \frac{2}{3} = \frac{1}{6}$

(c) $\frac{3}{5} \times \frac{1}{2} = \frac{3}{10}$

(d) $\frac{4}{6} \times \frac{3}{5} = \frac{2}{5}$

Page-183-184

1. Water tank problem

Tap fills $\frac{7}{10}$ tank in 1 hour.

(a) In $\frac{1}{3}$ hour :

$\frac{7}{10} \times \frac{1}{3} = \frac{7}{30}$

(b) In $\frac{2}{3}$ hour :

$\frac{7}{10} \times \frac{2}{3} = \frac{7}{15}$

(c) In $\frac{3}{4}$ hour :

$\frac{7}{10} \times \frac{3}{4} = \frac{21}{40}$

(d) In $\frac{7}{10}$ hour :

$\frac{7}{10} \times \frac{7}{10} = \frac{49}{100}$

(e) Time to fill whole tank :

$1 \div \frac{7}{10} = 1 \times \frac{10}{7} = \frac{10}{7} = 1\frac{3}{7}$ **hours**

2. Somu's land

Land taken = $\frac{1}{6}$

Remaining = $1 - \frac{1}{6} = \frac{5}{6}$

Krishna gets half of remaining :

$\frac{1}{2} \times \frac{5}{6} = \frac{5}{12}$

Bora gets $\frac{1}{3}$ of remaining :

$\frac{1}{3} \times \frac{5}{6} = \frac{5}{18}$

Somu keeps :

$\frac{5}{6} - (\frac{5}{12} + \frac{5}{18})$

$= \frac{15}{18} - (\frac{15}{36} + \frac{10}{36})$

$= \frac{15}{18} - \frac{25}{36} = \frac{5}{36}$

Ans.

(a) Krishna = $\frac{5}{12}$

(b) Bora = $\frac{5}{18}$

(c) Somu = $\frac{5}{36}$

3. Area of rectangle

Sides :

$3\frac{3}{4}$ ft = $\frac{15}{4}$ ft

$9\frac{3}{5} = \frac{48}{5}$ ft

Area = $(\frac{15}{4}) \times (\frac{48}{5})$ = 36 sq ft

4. Saplings problem

Number of saplings = 4

Number of gaps = 3

Distance = $3 \times \frac{3}{4} = \frac{9}{4} = 2\frac{1}{4}$ m

5. Which is heavier?

$1\frac{2}{15}$ of 500 g = $\frac{17}{15} \times 500 = 566\frac{2}{3}$ g

$\frac{3}{20}$ of 4 kg = $\frac{3}{20} \times 4000$ = 600 g

So, $\frac{3}{20}$ of 4 kg is heavier.

Page-196-198

1. Evaluate

$3 \div \frac{7}{9} = \frac{27}{7} = 3\frac{6}{7}$

$\frac{14}{4} \div 2 = \frac{14}{4} \times \frac{1}{2} = \frac{7}{4} = 1\frac{3}{4}$

$\frac{2}{3} \div \frac{2}{3} = 1$

$\frac{14}{6} \div \frac{7}{3} = \frac{14}{6} \times \frac{3}{7} = 1$

$\frac{4}{3} \div \frac{3}{4} = \frac{4}{3} \times \frac{4}{3} = \frac{16}{9} = 1\frac{7}{9}$

$\frac{8}{2} \div \frac{4}{15} = \frac{8}{2} \times \frac{15}{4} = 15$

$\frac{1}{5} \div \frac{1}{9} = \frac{1}{5} \times \frac{9}{1} = \frac{9}{5} = 1\frac{4}{5}$

$\frac{1}{6} \div \frac{11}{12} = \frac{1}{6} \times \frac{12}{11} = \frac{2}{11}$

$3\frac{2}{3} \div 1\frac{3}{8} = \frac{11}{3} \div \frac{11}{8} = \frac{11}{3} \times \frac{8}{11} = \frac{8}{3} = 2\frac{2}{3}$

2. Choose expression and solve

(a) Correct : $8 \div \frac{1}{4}$ = 32 bags

(b) Correct : $\frac{1}{2} \div 8 = \frac{1}{16}$ m

(c) Correct : $5 \div \frac{1}{6}$ = 30 loaves

3. Flour problem

$\frac{1}{4}$ kg for 12 rotis

For 6 rotis = $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$ kg

4. Pātīganita problem

$1 \div \frac{1}{6} = 6$

$1 \div \frac{1}{10} = 10$

$1 \div \frac{1}{13} = 13$

$1 \div \frac{1}{9} = 9$

$1 \div \frac{1}{12} = 12$

Sum = 50

5. Mira's novel

Read :

$\frac{1}{5}$ of 400 = $\frac{1}{5} \times 400 = 80$

$\frac{3}{10}$ of 400 = $\frac{3}{10} \times 400 = 120$

Total read = 80 + 120 = 200

Remaining = 400 – 200 = 200 pages

6. Car distance

16 km per litre

Using $23\frac{4}{5}$ litres = $\frac{119}{5}$

Distance = $16 \times \frac{119}{5} = 380\frac{4}{5}$ km

7. Vacation travel

Train = $5\frac{1}{6}$ hours = $\frac{31}{6}$

Plane = $\frac{1}{2}$ hour

Time saved = $\frac{31}{6} - \frac{1}{2} = \frac{14}{3} = 4\frac{2}{3}$ hours

8. Cake problem

Finished = $\frac{4}{5}$

Remaining = $\frac{1}{5}$

Shared among 3 friends :

$\frac{1}{5} \div 3 = \frac{1}{15}$ each

9. Product comparison

$(\frac{565}{465}) \times (\frac{707}{676})$

Product is :

- Less than $\frac{565}{465}$
- Less than $\frac{707}{676}$
- Greater than 1

Correct options : **(b), (d), (e)**

10. Shaded part

The shaded portion is $\frac{1}{8}$ of the whole square.

11. Ants and food sources

The ants start as one group.

At each junction, the group splits equally into two parts.

From the picture :

The ants split **once**, then **again**, and finally reach **two food sources**.

Each split divides the group into **half**.

So, the fraction reaching each food source is :

$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

Ans.

Fraction reaching the mango tree = $\frac{1}{4}$

Fraction reaching the sugarcane field = $\frac{1}{4}$

(The remaining ants are on other paths shown in the diagram.

12.

1. Expression 1

$1 - \frac{1}{2} = \frac{1}{2}$

2. Expression 2

$(1 - \frac{1}{2}) \times (1 - \frac{1}{3})$

$= \frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$

3. Expression 3

$(1 - \frac{1}{2}) \times (1 - \frac{1}{3}) \times (1 - \frac{1}{4}) \times (1 - \frac{1}{5})$

$= \frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} = \frac{1}{5}$

4. Expression 4

$(1 - \frac{1}{2}) \times (1 - \frac{1}{3}) \times (1 - \frac{1}{4}) \times (1 - \frac{1}{5}) \times$

$(1 - \frac{1}{6})$

$= \frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \frac{5}{6}$

$= \frac{1}{6}$

5. Expression 5 (The Full Product)

$(1 - \frac{1}{2}) \times (1 - \frac{1}{3}) \times (1 - \frac{1}{4}) \times (1 - \frac{1}{5}) \times$

$(1 - \frac{1}{6}) \times (1 - \frac{1}{7}) \times (1 - \frac{1}{8}) \times (1 - \frac{1}{9}) \times$

$(1 - \frac{1}{10})$

$= \frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \frac{5}{6} \times \frac{6}{7} \times \frac{7}{8} \times \frac{8}{9} \times \frac{9}{10}$

$= \frac{1}{10}$

The General Statement

For any whole number n (n ≥ 2), the product $(1 - \frac{1}{2}) \times (1 - \frac{1}{3}) \times \ldots \times (1 - \frac{1}{n})$ is always equal to $\frac{1}{n}$.

The Explanation

This is a telescoping product.

Each term of the form $(1 - \frac{1}{k})$ becomes $\frac{(k-1)}{k}$.

When we multiply $\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \ldots \times \frac{(n-1)}{n}$ the denominator of one fraction cancels with the numerator of the next fraction.

After all cancellations, only 1 (from the first numerator) and n (from the last denominator) remain.

Therefore, the final result is 1/n.

Puzzle Time!

The **Eight Queens Puzzle** is a classic problem in mathematics and computer science that requires placing 8 queens on an 8 .times 8 chessboard so that no two queens threaten each other. This means no two queens can share the same row, column, or diagonal.

Understanding the Constraints

The Queen is the most powerful piece in chess because she can move any number of squares along :

Vertical lines (columns).

Horizontal lines (rows).

Diagonal lines.

To solve the puzzle, every queen must be placed such that her path does not intersect with any other queen's path.

Solving the 4-Queens Puzzle

Before tackling the 8 \times 8 grid, consider a smaller 4 \times 4 grid. In the example provided in the text, the arrangement is invalid because the queens are in the line of attack. A valid solution for 4 queens is :

Row 1 : Column 2

Row 2 : Column 4

Row 3 : Column 1

Row 4 : Column 3

Placing 8 Queens on an 8 × 8 Grid

There are 92 distinct solutions to the 8-queens puzzle. One possible valid arrangement is listed below by row and column :

Row Number	Column Number
Row 1	Column 4
Row 2	Column 2
Row 3	Column 7
Row 4	Column 3
Row 5	Column 6
Row 6	Column 8
Row 7	Column 5
Row 8	Column 1

General Statement

This puzzle demonstrates that even with simple rules, finding a valid configuration becomes exponentially more difficult as the grid size increases. This problem is often used to teach "backtracking" algorithms in programming, where the computer places a queen, checks for validity, and "backtracks" to try a different spot if a conflict is found later in the process.

❑❑