

THT WORKSHEETS

Learn With the Solutions

Selective School Test Preparation

Mathematical Reasoning

These solutions focus on the observation or strategy that unlocks each problem. In Selective-style mathematics, recognising the structure of a question is often more valuable than beginning with lengthy calculations.

1.

Understanding the Question

We need to identify the rule connecting the numbers:

3, 6, 12, 24, 48, ...

Compare each term with the one before it:

$$3 \times 2 = 6$$

$$6 \times 2 = 12$$

$$12 \times 2 = 24$$

$$24 \times 2 = 48$$

The number doubles each time.

Continue the rule:

$$48 \times 2 = 96$$

Final Answer: 96

Selective Strategy

Check multiplication and division patterns before looking for more complicated rules.

2.

Understanding the Question

The stickers are shared in the ratio:

$$2 : 3 : 4 : 5$$

This does not mean the friends receive 2, 3, 4 and 5 stickers. It means the total is divided into equal ratio parts.

Step 1: Find the total number of parts

$$2 + 3 + 4 + 5 = 14 \text{ parts}$$

Step 2: Find the value of one part

$$84 \div 14 = 6$$

Each ratio part represents 6 stickers.

Step 3: Calculate each share

First friend:

$$2 \times 6 = 12$$

Second friend:

$$3 \times 6 = 18$$

Third friend:

$$4 \times 6 = 24$$

Fourth friend:

$$5 \times 6 = 30$$

Check

$$12 + 18 + 24 + 30 = 84$$

Final Answer: 12, 18, 24 and 30 stickers

Common Mistake

Do not divide 84 by 4 because there are four friends. The shares are unequal and must follow the stated ratio.

3.

Understanding the Question

A number is:

1. multiplied by 5;
2. increased by 18;
3. changed into 93.

To reverse the process, undo the operations in reverse order.

Step 1: Undo the addition

$$93 - 18 = 75$$

Step 2: Undo the multiplication

$$75 \div 5 = 15$$

Check

$$15 \times 5 = 75$$

$$75 + 18 = 93$$

Final Answer: 15

Selective Strategy

For reverse-operation questions, begin with the final answer and undo each operation in reverse order.

4.

Understanding the Question

The original square is first divided into 4 equal squares.

Each of those 4 squares is then divided into another 4 equal squares.

First division

1 square becomes 4 squares.

THT.

Second division

Each of the 4 squares becomes 4 smaller squares.

$$4 \times 4 = 16$$

Final Answer: 16 smallest squares

Common Mistake

Do not calculate $4 + 4$. The second division happens inside each of the four existing squares, so multiplication is required.

5.

Understanding the Question

Track the lift's position one move at a time.

Starting floor:

2

Move up 9 floors:

$$2 + 9 = 11$$

Move down 4 floors:

$$11 - 4 = 7$$

Move up 6 floors:

$$7 + 6 = 13$$

Move down 5 floors:

$$13 - 5 = 8$$

Final Answer: Floor 8

Quick Tip

Write the floor after every movement. Trying to combine all the moves mentally can lead to sign errors.

THT.

6.

Understanding the Question

The three numbers are consecutive, so they are equally spaced around the middle number.

The total is 126.

Step 1: Find the middle number

For three consecutive numbers, the average is the middle value.

$$126 \div 3 = 42$$

Step 2: Find the neighbouring numbers

One less than 42:

41

One more than 42:

43

Check

$$41 + 42 + 43 = 126$$

Final Answer: 41, 42 and 43

Selective Strategy

For an odd number of consecutive values, divide the total by the number of values to find the middle number.

7.

Understanding the Question

There are two types of animals:

- chickens with 2 legs;
- sheep with 4 legs.

There are 18 animals and 52 legs altogether.

THT.

Efficient reasoning method

Imagine first that all 18 animals are chickens.

Legs if all were chickens:

$$18 \times 2 = 36 \text{ legs}$$

But the actual total is 52 legs.

Extra legs:

$$52 - 36 = 16$$

Each sheep has 2 more legs than a chicken:

$$4 - 2 = 2$$

Number of sheep:

$$16 \div 2 = 8$$

Number of chickens:

$$18 - 8 = 10$$

Check

10 chickens:

$$10 \times 2 = 20 \text{ legs}$$

8 sheep:

$$8 \times 4 = 32 \text{ legs}$$

Total:

$$20 + 32 = 52 \text{ legs}$$

Final Answer: 10 chickens and 8 sheep

Selective Strategy

The “assume all are the smaller type” method is often faster than forming simultaneous equations.

8.

Understanding the Question

Look for the relationship between each input and output:

$$2 \rightarrow 5$$

$$4 \rightarrow 9$$

$$6 \rightarrow 13$$

Try multiplying each input by 2:

$$2 \times 2 = 4, \text{ then add 1 to get 5.}$$

$$4 \times 2 = 8, \text{ then add 1 to get 9.}$$

$$6 \times 2 = 12, \text{ then add 1 to get 13.}$$

The rule is:

$$\text{Output} = \text{Input} \times 2 + 1$$

For an input of 8:

$$8 \times 2 + 1$$

$$= 16 + 1$$

$$= 17$$

Final Answer: 17

9.

Understanding the Question

The rectangle has:

- perimeter 40 cm;
- length 4 cm greater than its width.

Let the width be W.

Then:

$$\text{Length} = W + 4$$

THT.

Step 1: Use the perimeter formula

Perimeter of a rectangle:

$$P = 2 \times (\text{length} + \text{width})$$

Substitute:

$$40 = 2[(W + 4) + W]$$

Divide both sides by 2:

$$20 = 2W + 4$$

Subtract 4:

$$16 = 2W$$

Divide by 2:

$$W = 8$$

Step 2: Find the length

$$\text{Length} = W + 4$$

$$= 8 + 4$$

$$= 12$$

Check

$$2 \times (12 + 8)$$

$$= 2 \times 20$$

$$= 40 \text{ cm}$$

Final Answer: Length = 12 cm; width = 8 cm

Common Mistake

Do not treat 40 cm as length + width. The perimeter contains two lengths and two widths.

10.

Understanding the Question

One train leaves every 18 minutes.

THT.

The other leaves every 24 minutes.

They next leave together after the lowest common multiple of 18 and 24 minutes.

List multiples

Multiples of 18:

18, 36, 54, 72, 90, ...

Multiples of 24:

24, 48, 72, 96, ...

The first common multiple is 72.

Therefore, the trains next leave together 72 minutes after 8:00 am.

Add the time

8:00 am + 60 minutes = 9:00 am

9:00 am + 12 minutes = 9:12 am

Final Answer: 9:12 am

Selective Strategy

When two repeating events must occur together again, look for the lowest common multiple.

11.

Understanding the Question

The bag contains three colours. We need the smallest number of counters that guarantees 3 of one colour.

To solve a guarantee question, consider the worst possible outcome.

Worst-case selection

You could draw:

2 red

2 blue

2 green

THT.

That is:

$$2 + 2 + 2 = 6 \text{ counters}$$

At this point, no colour has appeared 3 times.

The next counter must be red, blue or green.

Whichever colour appears, it creates a group of 3.

$$6 + 1 = 7$$

Final Answer: 7 counters

Key Idea

“Guarantee” means the answer must work even in the least favourable possible arrangement.

12.

Understanding the Question

The mystery number is 30.

We check each child’s statement.

Ella:

“30 is even.”

$$30 \div 2 = 15$$

This is true.

Noah:

“30 is greater than 20.”

$$30 > 20$$

This is true.

Zoe:

“30 is a multiple of 5.”

$$30 = 5 \times 6$$

This is true.

Final Answer: All three statements are true.

13.

Understanding the Question

The clock loses 4 minutes every actual hour.

It is correct at 8:00 am.

We need to find what it displays when the real time is 2:00 pm.

Step 1: Find the elapsed time

From 8:00 am to 2:00 pm:

6 hours

Step 2: Find the total time lost

4 minutes each hour:

$$6 \times 4 = 24 \text{ minutes}$$

Step 3: Subtract the lost time from the real time

Actual time:

2:00 pm

Clock is 24 minutes slow:

$$2:00 \text{ pm} - 24 \text{ minutes} = 1:36 \text{ pm}$$

Final Answer: 1:36 pm

Common Mistake

A clock that loses time shows an earlier time than the actual time. Do not add the 24 minutes.

14.

Understanding the Question

The four numbers:

- are different whole numbers;

THT.

- total 30;
- include a largest number of 12;
- include a smallest number of 4;
- have two remaining numbers differing by 2.

Step 1: Remove the known numbers from the total

Known total:

$$12 + 4 = 16$$

Remaining total:

$$30 - 16 = 14$$

The remaining two numbers must:

- add to 14;
- differ by 2.

Step 2: Find the pair

Half of 14 is 7.

Two numbers equally spaced around 7 and differing by 2 are:

6 and 8

Check

$$4 + 6 + 8 + 12 = 30$$

Largest number = 12

Smallest number = 4

$$8 - 6 = 2$$

All four numbers are different.

Final Answer: 4, 6, 8 and 12

Selective Strategy

When two numbers have a known sum and difference, find their midpoint first.

THT.

15.

Understanding the Question

There are 240 students.

Three-fifths play a sport.

One-quarter of those students also learn a musical instrument.

The second fraction applies only to the students who play sport.

Step 1: Find the students who play sport

$$240 \times \frac{3}{5}$$

First divide by 5:

$$240 \div 5 = 48$$

Then multiply by 3:

$$48 \times 3 = 144$$

So 144 students play a sport.

Step 2: Find one-quarter of those students

$$144 \div 4 = 36$$

Final Answer: 36 students

Common Mistake

Do not find one-quarter of all 240 students. The question says one-quarter of the students who play sport.

16.

Understanding the Question

The pattern is:

18, 27, 39, 54, 72, ...

Find the differences:

$$27 - 18 = 9$$

THT.

$$39 - 27 = 12$$

$$54 - 39 = 15$$

$$72 - 54 = 18$$

The differences are:

9, 12, 15, 18

They increase by 3 each time.

The next difference is:

$$18 + 3 = 21$$

Next term:

$$72 + 21 = 93$$

Final Answer: 93

Selective Strategy

When the terms do not follow a simple multiplication rule, examine the differences between consecutive terms.

17.

Understanding the Question

There are three possible colours and 10 marbles altogether.

We need to guarantee 4 marbles of the same colour.

Consider the worst-case distribution while avoiding 4 of any colour.

Worst case

You could take:

3 red

3 blue

3 yellow

That totals:

THT.

$$3 + 3 + 3 = 9 \text{ marbles}$$

At this point, no colour has appeared 4 times.

The tenth marble must be red, blue or yellow.

Whichever colour it is, that colour will then appear 4 times.

Final Answer: 10 marbles

Why the total number matters

Because the box contains exactly 10 marbles, drawing all 10 guarantees the condition.

Common Mistake

Do not assume the colours are evenly distributed in the box. The guarantee must work for every possible colour arrangement.

18.

Understanding the Question

We need a two-digit number such that:

- its digits total 11;
- reversing the digits makes the number 27 smaller.

Let:

tens digit = a

ones digit = b

Original number:

$$10a + b$$

Reversed number:

$$10b + a$$

Step 1: Use the difference

$$\text{Original} - \text{reversed} = 27$$

$$(10a + b) - (10b + a) = 27$$

THT.

$$10a + b - 10b - a = 27$$

$$9a - 9b = 27$$

$$9(a - b) = 27$$

$$a - b = 3$$

Step 2: Use the digit sum

$$a + b = 11$$

Now solve:

$$a + b = 11$$

$$a - b = 3$$

Add the equations:

$$2a = 14$$

$$a = 7$$

Substitute:

$$7 + b = 11$$

$$b = 4$$

The original number is 74.

Check

Digit sum:

$$7 + 4 = 11$$

Reversed number:

$$47$$

Difference:

$$74 - 47 = 27$$

Final Answer: 74

Selective Strategy

For reversed two-digit numbers, the difference is always 9 times the difference between the digits.

19.

Understanding the Question

The first square has side length 12 cm.

Its area is:

$$12 \times 12 = 144 \text{ cm}^2$$

The second square has twice this area:

$$144 \times 2 = 288 \text{ cm}^2$$

We must decide whether its side length is less than, equal to or greater than 17 cm.

Compare with a 17 cm square

Area of a square with side 17 cm:

$$17 \times 17 = 289 \text{ cm}^2$$

The required area is 288 cm^2 .

Since:

$$288 < 289$$

the required square must have a side length slightly less than 17 cm.

Final Answer: The side length is less than 17 cm.

Key Idea

There is no need to calculate the exact square root. Compare the required area with a nearby perfect square.

20.

Understanding the Question

The claim is:

“Every prime number is odd.”

A prime number has exactly two positive factors:

THT.

1 and itself.

Most prime numbers are odd:

3, 5, 7, 11, 13, ...

However, 2 is also prime because its only positive factors are 1 and 2.

The number 2 is even.

Therefore:

- the claim is true for many primes;
- the claim is false for the prime number 2.

Final Answer: Sometimes true

Common Mistake

Do not say “never true” because most prime numbers are odd. The single exception is 2.

Quick Answer Check

1. 96
2. 12, 18, 24 and 30
3. 15
4. 16
5. Floor 8
6. 41, 42 and 43
7. 10 chickens and 8 sheep
8. 17
9. Length = 12 cm; width = 8 cm
10. 9:12 am
11. 7 counters
12. All three statements are true.
13. 1:36 pm
14. 4, 6, 8 and 12
15. 36 students
16. 93
17. 10 marbles
18. 74
19. Less than 17 cm

THT.

20.Sometimes true