TMC - 1

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MATHS

Logical Minds Challenge
Sample Questions

Sample Question 1: *(Geometrical Shapes)*

Alex makes a design using different geometric shape:

- He uses **9 shapes altogether**.
- The total number of sides is **34**.
- He uses **2 pentagons**.

Each type of shape has a fixed number of sides.

(a) How many sides are contributed by the shapes that are **not pentagons**?
(b) Alex says, "I might have used 6 triangles."
Explain why this is not possible.
(c) How many squares and triangles does Alex use?

Sample Question 2: *(Numbers and Operations)*

A train starts with some passengers.

- At the first station, 9 passengers get off and 4 get on.
- At the second station, 5 passengers get off and 7 get on.
- After the second station, there are 22 passengers on the train.

(a) How many passengers were on the train before the first station?
(b) How many passengers were on the train after the first station?
(c) At the third station, 6 passengers want to get on. The train can carry a maximum of 35 passengers. After the 6 passengers board, how many empty spaces are left on the train?

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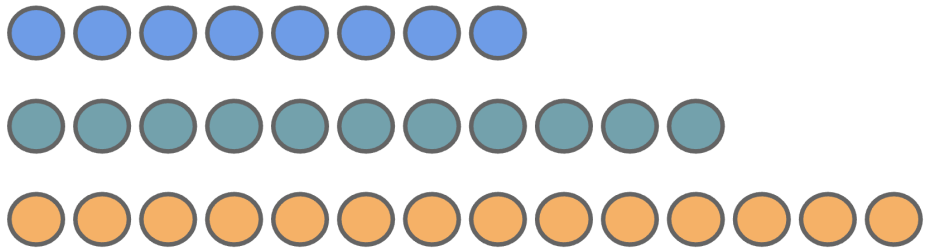
Logical Minds Challenge
Sample Questions

Sample Question 1: *(Number Pattern)*

A pattern is made using circles.

- Pattern 1 uses 8 circles
- Pattern 2 uses 11 circles
- Pattern 3 uses 14 circles



The pattern continues in the same way.

(a) How many circles are added each time?
(b) How many circles will pattern 6 use?
(c) Another student says pattern 8 uses 30 circles. Explain the mistake.
(d) If pattern 1 started with 10 circles instead, how many more circles would the new pattern 6 use compared to the original pattern 6?

Sample Question 2: *(Geometry)*

A rectangular garden is 25 m long and 15 m wide.

A runner goes around the garden 4 times and then walks across the width one additional time.

(a) Find the perimeter of the garden.
(b) Find the total distance for the 4 full rounds.
(c) A student says the total distance walked is 320 m. Is the student correct? Explain your answer.

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Logical Minds Challenge
Sample Questions

Sample Question 1: *(Percentages)*

A toy costs £50 and is sold at a discount of 20%.

(a) What is the discounted price of one toy?
(b) A customer buys some toys and pays £200 altogether. How many toys did the customer buy?
(c) Another customer buys the same number of toys, but every third toy is sold at half price. Who pays less? Explain your reasoning.

Sample Question 2: *(Volume & Rates)*

A tank holds 720 litres of water.

- One pipe fills the tank at 12 litres per minute.
- A leak drains 3 litres per minute.

(a) How long does one pipe take to fill the tank without the leak?
(b) How long does it take to fill the tank with the leak?
(c) A student says:

"Using two identical pipes will exactly halve the filling time." Is the student correct? Explain your reasoning.

(d) Without fully calculating the exact filling time, decide whether using three identical pipes **while the leak continues** would take:

- less than 20 minutes,
- exactly 20 minutes,
- or more than 20 minutes.

Explain your reasoning.

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Logical Minds Challenge
Sample Questions

Sample Question 1: *(Ratio and Percentage)*

At a toy shop, cars, dolls, and balls are sold in the ratio:

$$4 : 5 : 3$$

A total of 360 toys are sold.

- Cars cost £5 each
- Dolls cost £3 each
- Balls cost £2 each

(a) Explain how the ratio shows that 30 groups of toys were sold.

(b) Find the total amount collected.

(c) A student says more than 50% of the money came from cars. Without calculating the total income from each toy separately, explain whether more than half of the money came from cars.

Sample Question 2: *(Sequences)*

A sequence is defined by the formula $5n + 2$.

(a) Explain how you can determine whether 42 belongs to the sequence without listing terms.

(b) Describe all values of n for which 5n+25 is divisible by 3.

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Logical Minds Challenge
Sample Questions

Sample Question 1:

(Quadratic Functions)

A quadratic function has one root at -1 and axis of symmetry $x = 2$.
It passes through (0, 15).

(a) Find the other root.
(b) Find the equation of the quadratic function.
(c) Find the coordinates of the vertex and hence determine the maximum value.
(d) Without sketching the graph, determine the interval for which the function is positive. .

Sample Question 2: *(Numbers and Operations)*

A rescue boat travels from the north shore to the south shore at 15 m/s.
On the return journey, strong waves slow the boat to 10 m/s.
The return journey takes 3 minutes longer than the outward journey.

(a) Find the distance between the two shores.
(b) A boat travels outward at 8 m/s. A scientist claims that if a strong current helps the boat on the return trip, then the return journey will be 4 minutes shorter than the outward journey. Explain why the claim could be true without finding the exact return speed.
(c) Suppose the river in part (a) is three times wider, while the outward and return speeds remain 15 m/s and 10 m/s respectively. Find the total time for the complete round trip.

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Logical Minds Challenge
Sample Questions

Sample Question 1: *(Quadratic Functions)*

For the function $f(x) = x^2 - 4x - 5$:

(a) Without sketching the graph, determine the coordinates where the graph intersects the coordinate axes.
(b) Explain why the function does not have an inverse over all real numbers.
(c) Given that $x \geq 2$, find the inverse function.
(d) Without sketching either graph, determine whether: $f^{-1}(0)>0$

Sample Question 2:

A company sells each item for p pounds and can sell:

$$q = 400 - 5p$$

items per week. The cost of producing q items is:

$$C(q) = 1000 + 6q$$

(a) Express the profit P as a function of p.
(b) Without fully expanding the quadratic expression, explain why the profit function must have a maximum value.
(c) Find the value of p that maximises the profit.
(d) Determine the maximum profit and explain what this value represents in the context of the problem.