Grade 8 Math Model Paper 2

ANSWER KEY

Full marks 50 · 2 hours

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

A practice paper by Science Playground, made to CDC's Specification Grid 2078, Mathematics, Grades 6–8; not an official CDC or exam board paper.

Question 1 — 3 marks

a. A **universal set** is the set of all the elements under discussion: every set in the question is a subset of it. In a Venn diagram it is the rectangle. **[1]**

Marking scheme

- The set of all the elements under discussion, of which the other sets are subsets.

b. The common letters are $\{a, i\}$. Its subsets are $\{\}$, $\{a\}$, $\{i\}$ **and** $\{a, i\}$. **[1]**

Marking scheme

- All four subsets, with the empty set and the set itself.

c. a **and** i**.** Disjoint sets have no element in common, and these are the only two letters in both sets. Then $W = \{g, n, d, k\}$. **[1]**

Marking scheme

- a and i, with the reason (disjoint sets have no common element).

Question 2 — 4 marks

a. P is the **principal**, T the **time** in years and R the **rate** of interest in percent a year. **[1]**

Marking scheme

- Principal, time and rate.

b. **[1]**

$$I = \frac{75000 \times 1 \times 14}{100} = 10500$$

Rs 10,500.

Marking scheme

- Rs 10,500.

c. **[2]**

$$T = \frac{I \times 100}{P \times R} = \frac{31500 \times 100}{75000 \times 14} = 3$$

After 3 years. Check: $3 \times 10500 = 31500$ ✓.

Marking scheme

- The values put in the formula for T (or $31500 \div 10500$).
- 3 years.

Question 3 — 5 marks

a. The extremes are the two outer numbers: **2 and 15**. **[1]**

Marking scheme

- 2 and 15.

b. One worker makes $\frac{2400}{6 \times 4} = 100$ laddus in a day, so 8 workers make 800 in a day. **[2]**

$$\text{Days} = \frac{4000}{800} = 5$$

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

5 days.

Marking scheme

- 100 laddus by one worker in a day (or 800 by the eight workers).
- 5 days.

c. Marked price $= 20 + \frac{30}{100} \times 20 = 26$. For a profit of 17%, the selling price must be $20 + \frac{17}{100} \times 20 = 23.40$. **[2]**

Discount $= 26 - 23.40 = 2.60$, so

$$\text{Discount percent} = \frac{2.60}{26} \times 100\% = 10\%$$

He can give a discount of 10%.

Marking scheme

- Marked price Rs 26 and selling price Rs 23.40.
- A discount of 10%, taken on the marked price.

Question 4 — 5 marks

a. **[1]**

$$110101_2 = 32 + 16 + 4 + 1 = 53$$

53.

Marking scheme

- 53.

b. **[2]**

$$\frac{1.2 \times 10^{11}}{3 \times 10^6} = \frac{1.2}{3} \times 10^{11-6} = 0.4 \times 10^5 = 4 \times 10^4$$

4×10^4 **photos**, that is 40,000.

Marking scheme

- 0.4×10^5, dividing the numbers and subtracting the powers.
- 4×10^4.

c. One photo takes $\frac{9}{12} = 0.75$ seconds, so 20 photos take $20 \times 0.75 =$ **15 seconds**. **[1]**

Marking scheme

- 15 seconds.

d. **No.** The decimal of π never ends and never repeats: the calculator shows only the digits it has room for. And $\frac{22}{7}$ is only a value close to π, not π itself. So π is irrational. **[1]**

Marking scheme

- No, with the reason (its decimal never ends or repeats; $\frac{22}{7}$ is only close to it).

Question 5 — 5 marks

a. **[1]**

$$A = \frac{1}{2} d_1 d_2$$

Marking scheme

- $A = \frac{1}{2} d_1 d_2$.

b. $d_1 = AC = 20 + 36 = 56$ cm and $d_2 = BD = 15 + 15 = 30$ cm. **[1]**

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

$$A = \frac{1}{2} \times 56 \times 30 = 840$$

840 cm².

Marking scheme

- 840 cm².

c. The radius is 10.5 cm, so the picture's area is $\frac{22}{7} \times 10.5 \times 10.5 = 346.5$ cm². **[2]**

Not covered: $840 - 346.5 =$ **493.5 cm²**.

Marking scheme

- The picture's area, 346.5 cm².
- 493.5 cm².

d. By Pythagoras' theorem, $AB = \sqrt{20^2 + 15^2} = 25$ cm and $BC = \sqrt{15^2 + 36^2} = 39$ cm. A kite has two pairs of equal sides, so the edge is $2 \times (25 + 39) = 128$ cm. **No: he is 8 cm short.** **[1]**

Marking scheme

- No, with the edge of 128 cm as the reason.

Question 6 — 3 marks

a. $\frac{1}{x^m}$ **[1]**

Marking scheme

- $\frac{1}{x^m}$.

b. **[2]**

$$\frac{x^2 - 16}{x^2 + 4x} = \frac{(x+4)(x-4)}{x(x+4)} = \frac{x-4}{x}$$

$\frac{x-4}{x}$

Marking scheme

- Top and bottom factorized: $\frac{(x+4)(x-4)}{x(x+4)}$.
- $\frac{x-4}{x}$.

Question 7 — 3 marks

a. **The solution of the equations:** its x and y make both equations true. **[1]**

Marking scheme

- The solution of the two equations.

b. For $x + y = 9$, that is $y = 9 - x$: **[2]**

x	**0**	**3**	**9**
y	9	6	0

For $x - y = 3$, that is $y = x - 3$:

x	**3**	**5**	**6**
y	0	2	3

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

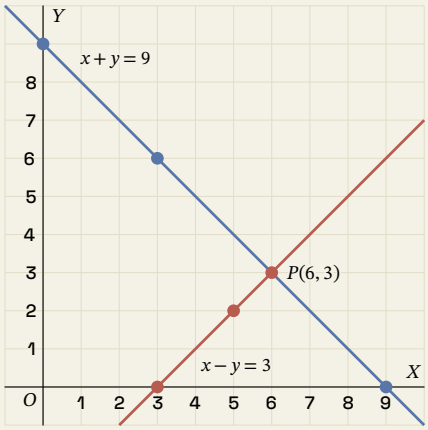


Figure 3 The two lines cross at $(6, 3)$.

The lines cross at $(6, 3)$. Check: $6 + 3 = 9$ ✓ and $6 - 3 = 3$ ✓. $x = 6, y = 3$: **6 boys and 3 girls.**

Marking scheme

- Both tables, and both lines drawn on the graph.
- $x = 6, y = 3$: 6 boys and 3 girls.

Question 8

4 marks

a. **[2]**

$$2x^2 - 8 = 2(x^2 - 4) = 2(x + 2)(x - 2)$$
$$x^2 + 3x + 2 = x^2 + 2x + x + 2 = (x + 2)(x + 1)$$

LCM $= 2(x + 2)(x - 2)(x + 1)$**.** The shared factor $(x + 2)$ is counted once.

Marking scheme

- Both expressions factorized.
- LCM $= 2(x + 2)(x - 2)(x + 1)$.

b. Let the pages be x and $x + 1$. Then $x(x + 1) = 506$, so $x^2 + x - 506 = 0$. **[2]**

Two numbers that multiply to -506 and add up to 1 are 23 and -22:

$$(x + 23)(x - 22) = 0$$

So $x = -23$ or $x = 22$. A page number can't be negative, so $x = 22$. **The pages are 22 and 23.** Check: $22 \times 23 = 506$ ✓.

Marking scheme

- The equation $x^2 + x - 506 = 0$, factorized.
- Pages 22 and 23, with the negative root left out.

Question 9

4 marks

a. **Co-interior angles.** They are between the two lines, on the same side of the transversal. **[1]**

Marking scheme

- Co-interior angles.

b. Co-interior angles between parallel lines add up to 180°, so $\angle N_1QP = 180^\circ - 65^\circ =$ **115°**. **[2]**

The bearing is the clockwise turn from QN_1 to QP, the reflex angle: $360^\circ - 115^\circ =$ **245°**. (The same as $065^\circ + 180^\circ$.)

Marking scheme

- $\angle N_1QP = 115^\circ$.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

- The bearing of P from Q is 245°.

c. **No.** The first square of the column and the last square of the row would both land on the side opposite the third square of the column, so they overlap and one side of the cube stays open. **[1]**

Marking scheme

- No, with the reason (two squares land on the same side, leaving one side open).

Question 10 — 5 marks

a. Sketch the square first. Draw $AB = 5.5$ cm. At A, construct 90° with a compass, and cut 5.5 cm on that arm to get D. At B, construct 90° in the same way and cut 5.5 cm to get C. Join C and D. **[3]**

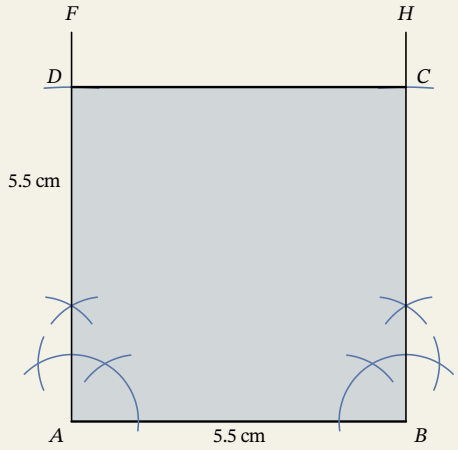


Figure 6 $ABCD$ with its arcs. See the steps in Construct it.

Marking scheme

- $AB = 5.5$ cm drawn, with a rough sketch.
- The right angles at A and B drawn with a compass.
- AD and BC cut at 5.5 cm, and the square completed.

b. **[2]**

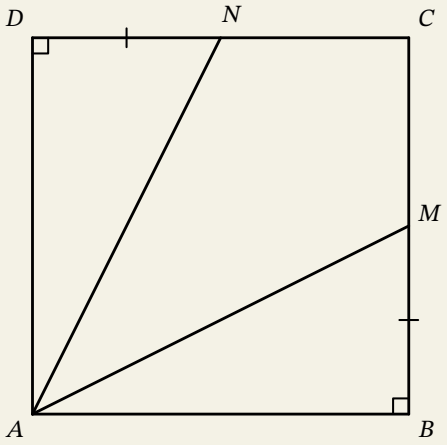


Figure 7 M and N are the midpoints of BC and CD.

	Statements	Reasons
1.	$AB = AD$ (S)	sides of a square
2.	$\angle ABM = \angle ADN$ (A)	both are right angles
3.	$BM = DN$ (S)	halves of the equal sides BC and CD
4.	$\triangle ABM \cong \triangle ADN$	SAS

Proved.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

Marking scheme

- The three pairs (two sides and the angle between them), with their reasons.
- $\triangle ABM \cong \triangle ADN$ by SAS, with the letters in matching order.

Question 11 — 6 marks

a. **A square.** Four squares meet at each corner. **[1]**

Marking scheme

- A square.

b. The rule is $(-5, -4)$, so $(x, y) \to (x - 5, y - 4)$. **[2]**

$A'(-4, -3)$, $B'(2, -3)$ **and** $C'(-1, 1)$.

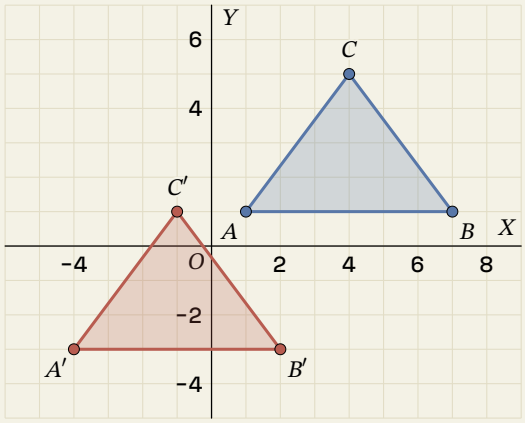


Figure 9 $\triangle ABC$ and its image.

Marking scheme

- The rule used: 5 taken from each x and 4 from each y.
- $A'(-4, -3)$, $B'(2, -3)$ and $C'(-1, 1)$.

c. $A(1, 1)$, $B(7, 1)$ and $C(4, 5)$. **[3]**

$$AB = \sqrt{(7-1)^2 + (1-1)^2} = \sqrt{36} = 6$$
$$AC = \sqrt{(4-1)^2 + (5-1)^2} = \sqrt{9+16} = 5$$
$$BC = \sqrt{(4-7)^2 + (5-1)^2} = \sqrt{9+16} = 5$$

$AC = BC$, so **it is an isosceles triangle**.

Marking scheme

- $AB = 6$ units.
- $AC = 5$ units and $BC = 5$ units.
- An isosceles triangle, because $AC = BC$.

Question 12 — 3 marks

a. 35 comes twice and every other number once. **The mode is 35.** **[1]**

Marking scheme

- 35.

b. In order: 35, 35, 39, 42, 45, 48, 56, 60. **[2]**

There are 8 numbers, so the median is the mean of the 4th and 5th:

$$\text{Median} = \frac{42 + 45}{2} = 43.5$$

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

43.5 visitors.

Marking scheme

- The data put in order, with 42 and 45 as the middle two.
- 43.5.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking