Specimen Paper A

MID-YEAR EXAMINATION
MATHEMATICS – PART 2

Marks: /50

Time: 1 hour 15 minutes

Name:	Date: ....

INSTRUCTIONS TO CANDIDATES

1. Answer **all** the questions.
2. Calculators may be used in this paper.
3. All working must be clearly shown. Omission of essential working will result in loss of marks.
4. The marks for each question is shown in brackets [ ] at the end of each question.
5. Answers are to be given correct to 3 significant figures if they are not exact and the degree of accuracy is not specified in the paper.

Section A (22 marks)
Answer **all** the questions in this section.

1 Use your calculator to evaluate each of the following. Give your answer correct to 3 significant figures.

(a) $\dfrac{\sqrt{2048} - \sqrt[3]{7655} \div 27^3}{(-25)^2 - (-12)^3}$

Answer (a) .... [1]

(b) $3.628 \times \left(36.8 - \dfrac{2.8}{5.6} + 6.75\right) \div 9.38$

Answer (b) .... [1]

(c) $\dfrac{5\frac{1}{2} - 2\frac{1}{3}}{\left(-4\frac{2}{3}\right)^2 \div \left(-3\frac{1}{2}\right)^3}$

Answer (c) .... [1]

2 **(a)** A faulty watch gains x seconds in one hour. Write down an expression for the number of minutes it would gain in y days. Give your answer in its simplest form.

Answer (a) .... min [2]

(b) If $x = -3$ is a solution of the equation $2x^2 - 5x - 3p = 0$, find the value of p.

Answer (b) $p =$ .... [2]

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3 Solve the following equations.

(a) $8x - 7 = 11 - 2(3 - 2x)$

Answer (a) $x =$ .... [2]

(b) $\frac{3x - 4}{3} - \frac{1}{2} = \frac{x + 9}{6}$

Answer (b) $x =$ .... [2]

4 **(a)** A wall measuring 306 cm by 540 cm is to be completely covered by an abstract mural which is constructed by using similar size of coloured square panels.

(i) Find the area of the largest square panel that can be used to completely cover the wall without cutting any of the square panels.

Answer (a) (i) .... cm^2 [3]

(ii) Find the total number of these panels required to completely cover the wall.

Answer (a) (ii) .... panels [1]

(b) The largest of five consecutive even numbers is x. Given that three times the middle number is 52 less than four times the smallest number, find the value of x.

Answer (b) $x =$ .... [2]

5 The tickets for a magic show were priced at \$3, \$5 and \$8. The number of \$3 tickets sold was 30 more than the number of \$5 tickets. The number of \$5 tickets sold was twice the number of \$8 tickets. The number of \$8 tickets sold was x.

(a) Find, an expression in terms of x, for the total amount of money received from the sale of the tickets.

Answer (a) \$ .... [3]

(b) Given that the total sales of the tickets was \$8010, form an equation in x. Solve this equation and hence find the total number of tickets sold.

Answer (b) .... tickets [2]

Section B (28 marks)
Answer **all** the questions in this section.

6 Simplify each of the following.

(a) $2(2x - 5y) - 3[5(y - x) - 6(2x - y)]$

Answer (a) .... [2]

(b) $2x \div \frac{6x}{7xy} \times \frac{9xy}{56x^2y^3}$

Answer (b) .... [2]

(c) $\frac{1}{2}(x + y) - \frac{1}{4}(2x - y) + \frac{1}{6}(3x - 2y)$

Answer (c) .... [3]

7 (a) Express as a single fraction $5 + \frac{2-3x}{7x}$.

Answer (a) .... [2]

(b) A boy planned to buy some chocolate bars priced at 50 cents each but instead decided to purchase 30-cent chocolate bars with the same amount of money. If he got 14 more bars, how many 50-cent chocolate bars could he have bought?

Answer (b) .... bars [3]

8 (a) (i) If $\sqrt{2} = p$, $\sqrt{5} = q$ and $\sqrt{7} = r$, find in terms of p, q and r the value of $\sqrt{17\frac{1}{2}}$.

Answer (a) (i) .... [2]

(ii) The average height of $(a + 1)$ girls and a boys is x cm. If the average height of the boys is $(x - 1)$ cm, find an expression for the average height of the girls.

Answer(a) (ii) .... cm [3]

(b) $\frac{3}{7}$ of the participants who took part in the International Mathematics Olympiad last year were from Asia while $\frac{1}{3}$ of the remainder were from Europe. The rest of the participants were from North America and Australia. The number of participants from North America was 4 times the number of participants from Australia. If there were 2000 participants from Europe, find

(i) the total number of participants who took part in the Mathematics Olympiad last year,

Answer(b) (i) .... participants [2]

(ii) the fraction of participants from North America and Australia,

Answer(b) (ii) .... [1]

(iii) the number of participants from Australia.

Answer(b) (iii) .... participants [1]

9 The sequence of diagrams below are made up of dots and straight lines.

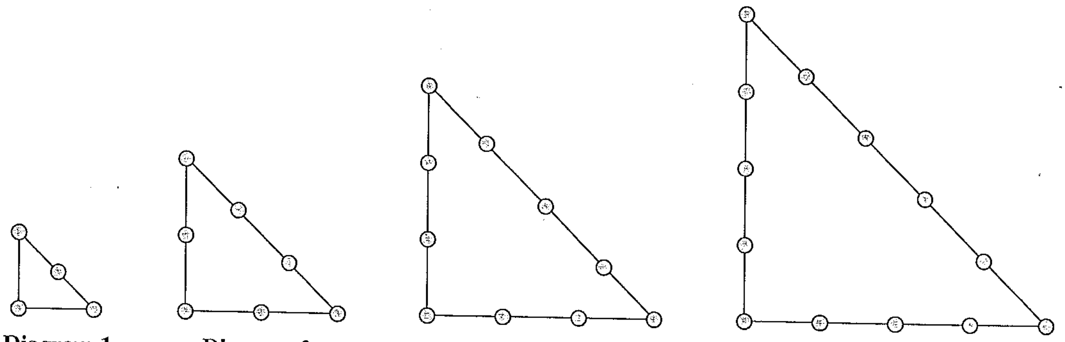

Diagram 1 **Diagram 2** **Diagram 3** **Diagram 4**

(a) Draw Diagram 5 of the sequence.

Answer (a) [1]

Diagram 5

(b) Complete the table below.

Answer (b)

Diagram number	1	2	3	4	5
Number of dots	4	7			

[1]

(c) How many dots are there in Diagram 10?

Answer (c) .... dots [2]

(d) Write down an expression in terms of n for the number of dots in Diagram n.

Answer (d) .... dots [1]

(e) Find the number of dots in Diagram 50.

Answer (e) .... dots [1]

(f) Which diagram has 565 dots?

Answer (f) Diagram .... [1]

(ii) $\dfrac{a^2c}{b} = \dfrac{\left(\frac{1}{2}\right)^2(-3)}{\frac{1}{5}}$

$= \left(\dfrac{1}{4}\right)(-3) \times \dfrac{5}{1}$

$= \dfrac{-15}{4}$

$= \mathbf{-3\frac{3}{4}}$

11. (a) (i) 348.638 ≈ **350** (correct to 2 sig. fig.)

(ii) 0.03985 ≈ **0.040** (correct to 2 sig. fig.)

(b) 348.638 × 0.03985
≈ 350 × 0.040
≈ 14
≈ **10** (correct to 1 sig. fig.)

12. (a) $2(5 - x) = 3x - 5$
$10 - 2x = 3x - 5$
$10 + 5 = 3x + 2x$
$15 = 5x$
$x = \dfrac{15}{5} = \mathbf{3}$

(b) $1\frac{1}{3}y = -8$

$y = \dfrac{-8}{1\frac{1}{3}}$

$= -8 \div \dfrac{4}{3}$

$= -\not{8}^{\,2} \times \dfrac{3}{\not{4}_1}$

$= \mathbf{-6}$

13. (a) No. of bangles bought
$= \mathbf{x + 3}$

(b) Total amount of money spent
$= \$[3x + 5(x + 3)]$
$= \$[3x + 5x + 15]$
$= \mathbf{\$[8x + 15]}$

14. (a) Difference in temperatures
= 69.5°C – (–78.5°C)
= 69.5°C + 78.5°C
= **148°C**

Teacher's Tip

Subtract the lowest temperature recorded from the highest temperature recorded.

(b) Required temperature
= –78.5°C + 59°C
= **–19.5°C**

15. Fraction of money donated to charity

$= \left(1 - \dfrac{3}{5}\right) \div 2$

$= \dfrac{2}{5} \div 2$

$= \dfrac{2}{5} \times \dfrac{1}{2}$

$= \dfrac{1}{5}$

$\therefore \dfrac{1}{5}$ of remainder = \$35

Remainder = 5 × \$35 = \$175
Original amount of money
= \$50 + \$175 = **\$225**

16. (a) Next line of pattern
= **119 + 121 + 123 = 3(121) = 363**

(b) $d = 453 \div 3 = 151$
$\therefore b = d = 151$
$a = 151 - 2 = 149$
$c = 151 + 2 = 153$

$\therefore a = \mathbf{149}$, $b = \mathbf{151}$, $c = \mathbf{153}$ and $d = \mathbf{151}$.

Mid-Year Examination Specimen Paper A: Part 2

Section A

1. (a) $\dfrac{\sqrt{2048} - \sqrt[3]{7655} \div 27^3}{(-25)^2 - (-12)^3}$

≈ **0.0192** (correct to 3 sig. fig.)

(b) $3.628 \times \left(36.8 - \dfrac{2.8}{5.6} + 6.75\right) \div 9.38$

≈ **16.7** (correct to 3 sig. fig.)

(c) $\dfrac{5\frac{1}{2} - 2\frac{1}{3}}{\left(-4\frac{2}{3}\right)^2 \div \left(-3\frac{1}{2}\right)^3}$

≈ **–6.23** (correct to 3 sig. fig.)

2. (a) The watch gains x seconds in one hour. (Given)

The watch gains $\dfrac{x}{60}$ minutes in one hour.

In one day, the watch gains $\dfrac{24x}{60} = \dfrac{2}{5}x$ minutes

In y days, the watch gains $\mathbf{\frac{2}{5}xy}$ minutes

(b) $2x^2 - 5x - 3p = 0$
When $x = -3$,
$2(-3)^2 - 5(-3) - 3p = 0$
$18 + 15 - 3p = 0$
$33 = 3p$
$p = \dfrac{33}{3} = \mathbf{11}$

3. (a) $8x - 7 = 11 - 2(3 - 2x)$
$8x - 7 = 11 - 6 + 4x$
$8x - 7 = 5 + 4x$
$4x = 12$
$x = \frac{12}{4} = \mathbf{3}$

(b) $\frac{3x-4}{3} - \frac{1}{2} = \frac{x+9}{6}$
$2(3x - 4) - 3 = x + 9$
$6x - 8 - 3 = x + 9$
$6x - 11 = x + 9$
$5x = 20$
$x = \frac{20}{5} = \mathbf{4}$

Multiply both sides by 6, the LCM of 3, 2 and 6.

4. (a) (i)

Teacher's Tip
The HCF of 306 and 540 gives the length of each side of the square panel.

$306 = 2 \times 3^2 \times 17$
$540 = 2^2 \times 3^3 \times 5$
$\therefore$ HCF $= 2 \times 3^2 = 18$

Length of side of largest square panel
$= 18$ cm

Area of largest square panel
$= 18 \times 18$
$= \mathbf{324\ cm^2}$

(ii) Total no. of panels
$= \frac{306 \times 540}{324}$
$= \mathbf{510}$

(b) The largest of five consecutive even numbers is x. (Given)
$\therefore$ the middle number is $(x - 4)$ and the smallest number is $(x - 8)$.
$4(x - 8) = 3(x - 4) + 52$
$4x - 32 = 3x - 12 + 52$
$4x - 32 = 3x + 40$
$x = \mathbf{72}$

Check answer:
The 5 numbers are 64, 66, 68, 70, 72.
$4(64) = 256$
$3(68) + 52 = 256$

5. (a) The number of \$8 tickets sold was x. (Given)
$\therefore$ the number of \$5 tickets sold was $2x$ and the number of \$3 tickets sold was $(2x + 30)$.

Total amount of money
$= \$[8x + 5(2x) + 3(2x + 30)]$
$= \$[8x + 10x + 6x + 90]$
$= \mathbf{\$[24x + 90]}$

(b) $\$[24x + 90] = \$8010$
$24x + 90 = 8010$
$24x = 7920$
$x = \frac{7920}{24} = 330$

$\therefore$ the total number of tickets sold was **330**.

Section B

6. (a) $2(2x - 5y) - 3[5(y - x) - 6(2x - y)]$
$= 4x - 10y - 3[5y - 5x - 12x + 6y]$
$= 4x - 10y - 3[11y - 17x]$
$= 4x - 10y - 33y + 51x$
$= \mathbf{55x - 43y}$

(b) $2x \div \frac{6x}{7xy} \times \frac{9xy}{56x^2y^3}$
$= 2x \times \frac{7xy}{6x} \times \frac{9xy}{56x^2y^3}$
$= \mathbf{\frac{3}{8y}}$

(c) $\frac{1}{2}(x + y) - \frac{1}{4}(2x - y) + \frac{1}{6}(3x - 2y)$
$= \frac{6(x + y) - 3(2x - y) + 2(3x - 2y)}{12}$
$= \frac{6x + 6y - 6x + 3y + 6x - 4y}{12}$
$= \mathbf{\frac{6x + 5y}{12}}$

The LCM of 2, 4 and 6 is 12.

7. (a) $5 + \frac{2 - 3x}{7x}$
$= \frac{5(7x) + (2 - 3x)}{7x}$
$= \frac{35x + 2 - 3x}{7x}$
$= \mathbf{\frac{32x + 2}{7x}}$

(b) Let the number of 50-cent chocolate bars be x.
$\therefore$ the number of 30-cent chocolate bars will be $(x + 14)$.
$\therefore 50x = 30(x + 14)$
$50x = 30x + 420$
$20x = 420$
$x = \frac{420}{20}$
$= 21$

$\therefore$ he could have bought **21** bars.

8. (a) (i) $\sqrt{2} = p$, $\sqrt{5} = q$ and $\sqrt{7} = r$ (Given)

$$\sqrt{17\frac{1}{2}} = \sqrt{\frac{35}{2}}$$

Express $17\frac{1}{2}$ as an improper fraction.

$$= \sqrt{\frac{5 \times 7}{2}}$$
$$= \frac{\sqrt{5} \times \sqrt{7}}{\sqrt{2}}$$
$$= \frac{q \times r}{p}$$
$$= \frac{qr}{p}$$

(ii) Total height of girls and boys
$= [(a + 1) + a]x$
$= (2a + 1)x$
$= (2ax + x)$ cm

Total height of boys
$= a(x - 1)$
$= ax - a$

Total height of girls
$= (2ax + x) - (ax - a)$
$= 2ax + x - ax + a$
$= (ax + x + a)$ cm

Average height of girls
$= \left(\frac{\mathbf{ax + x + a}}{\mathbf{a + 1}}\right)$ **cm**

(b) (i) Fraction of participants from Europe

$= \frac{1}{3} \times \left(1 - \frac{3}{7}\right)$
$= \frac{1}{3} \times \frac{4}{7}$
$= \frac{4}{21}$

$\frac{4}{21}$ of participants = 2000

$\frac{1}{21}$ of participants = $\frac{2000}{4}$ = 500

Total no. of participants = 21 × 500 = **10 500**

(ii) Fraction of participants from North America and Australia

$= 1 - \frac{3}{7} - \frac{4}{21}$
$= \mathbf{\frac{8}{21}}$

(iii) Total no. of participants from North America and Australia

$= \frac{8}{21} \times 10\,500$
$= 4000$

No. of participants from Australia
$= \frac{1}{5} \times 4000$
$= \mathbf{800}$

9. (a)

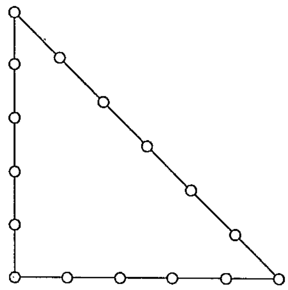

Diagram 5

(b)

Diagram no.	1	2	3	4	5
No. of dots	4	7	**10**	**13**	**16**

(c) Number of dots
Diagram 1: 3(1) + 1 = 4
Diagram 2: 3(2) + 1 = 7
Diagram 3: 3(3) + 1 = 10
⋮
Diagram 10: 3(10) + 1 = 30 + 1 = **31**

(d) No. of dots in Diagram n
$= 3(n) + 1$
$= \mathbf{3n + 1}$

Alternative method:
No. of dots in Diagram n
$= 4 + (n - 1)(3)$
$= 4 + 3n - 3$
$= \mathbf{3n + 1}$

Teacher's Tip
Use the formula $a + (n - 1)d$, where a = first term and d = difference between consecutive terms.

(e) No. of dots in Diagram 50
$= 3(50) + 1$
$= 150 + 1$
$= \mathbf{151}$

(f) $3n + 1 = 565$
$3n = 564$
$n = \frac{564}{3} = 188$
∴ diagram **188** has 565 dots.

Mid-Year Examination Specimen Paper B: Part 1

1. 58.13 + 4.926 = 63.056
(a) 63.056 ≈ **63.1** (correct to 3 sig. fig.)
(b) 63.056 ≈ **63.06** (correct to 2 d.p.)