



Basic Education

KwaZulu-Natal Department of Basic Education
REPUBLIC OF SOUTH AFRICA

MATHEMATICS

COMMON TEST

MARCH 2015

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

MARKS: 75

TIME: 1½ hours

N.B. This question paper consists of 5 pages including this page.

INSTRUCTIONS AND INFORMATION

Read the following instruction carefully before answering the questions.

1. The question paper consists of 4 questions.
2. Answer **ALL** the questions.
3. Clearly show all calculations and diagrams that you have used in determining your answering.
4. You may use an approved scientific calculator (non-programmable and non-graphical).
5. If necessary round off answers to **TWO** decimal places, unless otherwise stated.
6. Answers only will not be awarded full marks.
7. Diagrams not necessarily drawn to scale.
8. Number the answers correctly according to the numbering system used in this question paper.
9. Write neatly and legibly.

QUESTION ONE1.1 Simplify fully, **without using a calculator**.

$$1.1.1 \left(\frac{1}{729}\right)^{-\frac{2}{3}} \quad (2)$$

$$1.1.2 \frac{5^{2-m} \cdot 10^m}{2^{m-1}} \quad (3)$$

$$1.1.3 \frac{5 \cdot 2^{y+1} - 2^y}{2^{y-1}} \quad (3)$$

$$1.2 \text{ Show that: } \frac{9 - \sqrt{54}}{6\sqrt{2}} = \frac{3\sqrt{2} - 2\sqrt{3}}{4} \quad (3)$$

[11]**QUESTION TWO**2.1 Solve for x .

$$2.1.1 \quad x(2x - 1) = 0 \quad (2)$$

$$2.1.2 \quad 5x^2 = 3x + 4 \quad (\text{correct to two decimal places}) \quad (4)$$

$$2.1.3 \quad \sqrt{7x + 2} = 2x \quad (4)$$

2.2 Solve the following equations simultaneously.

$$\begin{aligned} x + y &= 6 \\ x^2 + 2xy - 8y^2 &= 0 \end{aligned} \quad (6)$$

2.3 Solve for x .

$$-2x(x - 3) \leq 4 \quad (4)$$

2.4

2.4.1 The roots of a quadratic equation are:

$$x = \frac{2 \pm \sqrt{m + 6}}{2}$$

For which values of m are the roots unreal? (2)2.4.2 For which values of p will the roots of $x^2 - 5x = -p$ have real roots? (3)**[25]**

QUESTION THREE

Given the quadratic equation:

4 ; 7 ; 14 ; 25 ; m

3.1 Write down the value of m . (2)

3.2 Determine the n^{th} term of the sequence. (4)

3.3 If the first difference between the two consecutive terms in the quadratic sequence is **87**, determine the value of the **two** consecutive terms. (4)

3.4 Calculate n if the n^{th} term in the sequence is **4855**. (4)

[14] ()

QUESTION FOUR

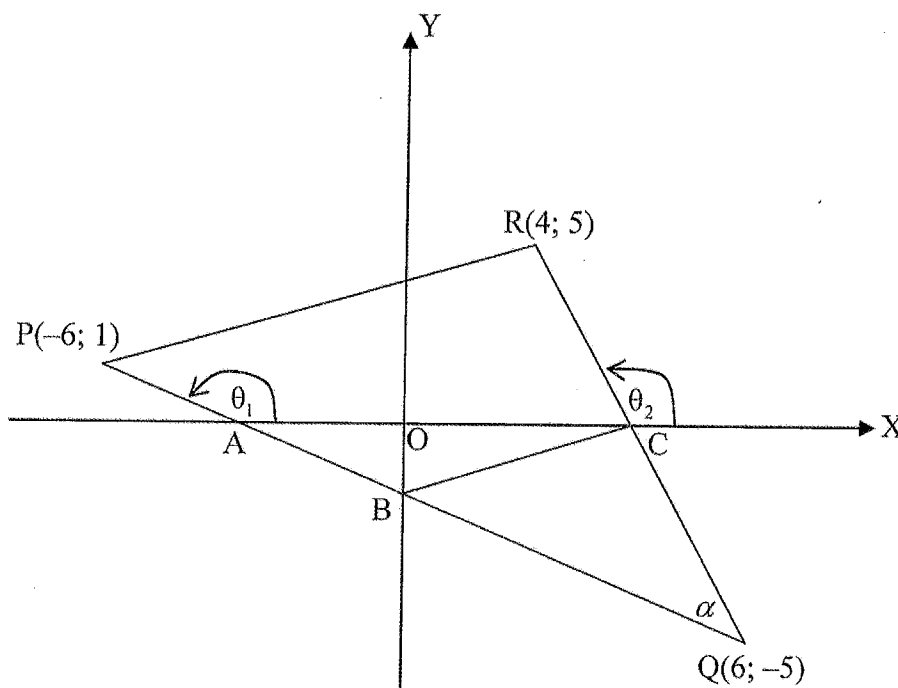
$P(-6; 1)$, $Q(6; -5)$ and $R(4; 5)$ are the co-ordinates of $\triangle PQR$.

C is the midpoint of QR . A , B and C are the intercepts of lines PQ and QR respectively.

$$\widehat{BQC} = \alpha$$

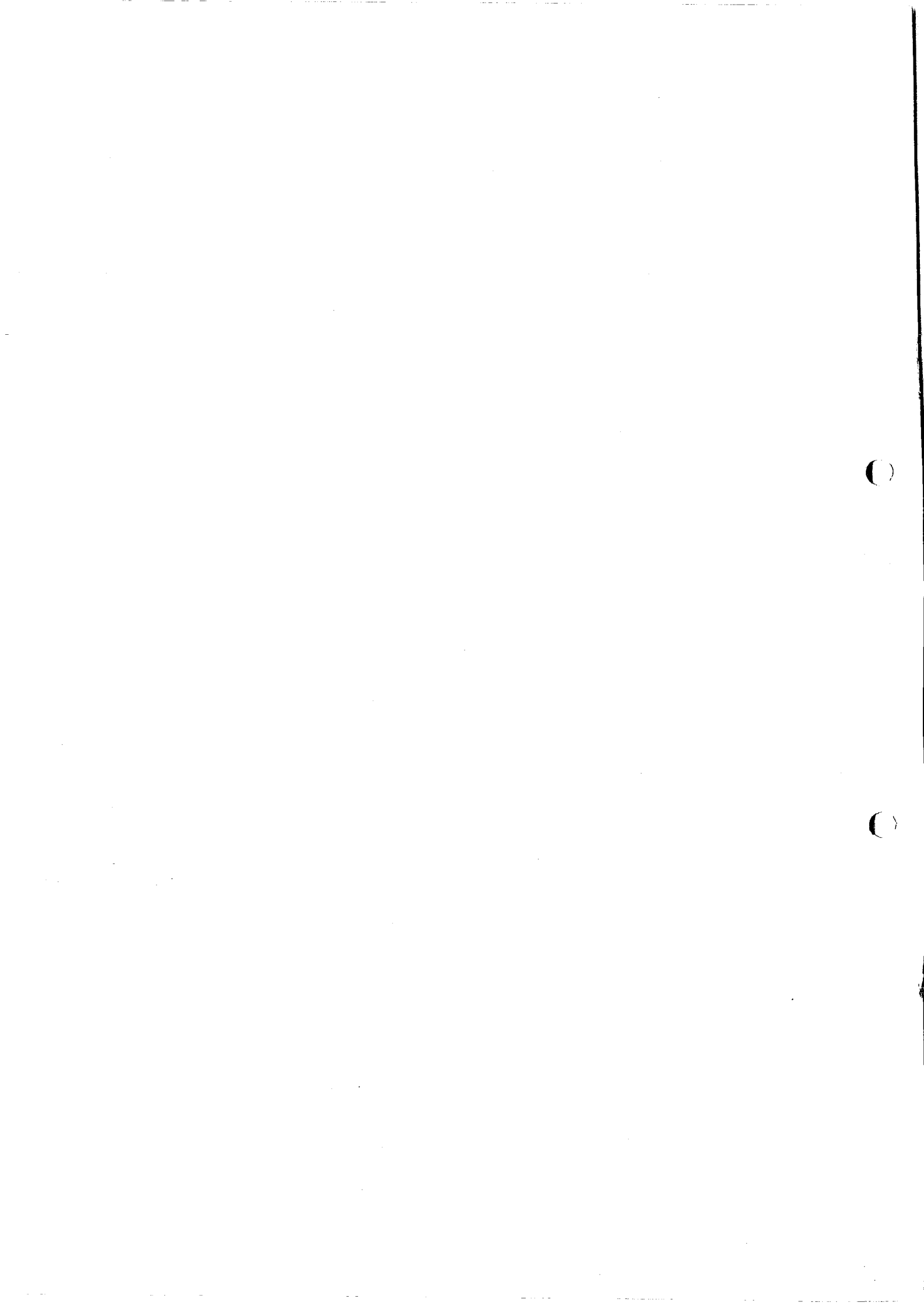
$$\widehat{PAX} = \theta_1 \text{ and}$$

$$\widehat{RCX} = \theta_2$$



- 4.1 Calculate the co-ordinates of C , the midpoint of QR . (2)
- 4.2 Determine the gradient of PQ . (2)
- 4.3 Determine the equation of PQ . (3)
- 4.4 Calculate the distance PR . (leave your answer in simplified surd form). (3)
- 4.5 Hence, or otherwise, show that $PR = 2 \cdot BC$. (3)
- 4.6 Prove $BC \parallel PR$. (3)
- 4.7 Calculate the size of α . (5)
- 4.8 Determine the equation of a line passing through P , and is perpendicular to PQ . (4)

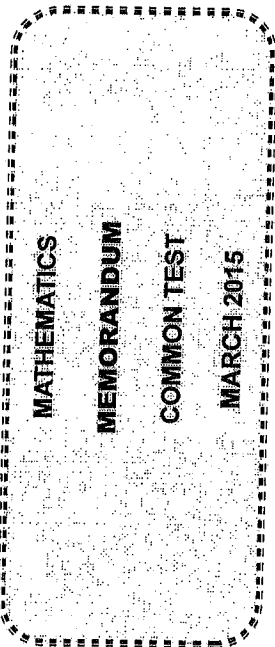
[25]





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QUESTION ONE

1.1

$$1.1.1 \quad (3)^{-4} = 3^4 = 81$$

OR

$$(9^{-2})^2 = 9^2 = 81$$

OR

$$(3^{-6})^{\frac{2}{3}} = 3^4 = 81$$

- ✓ 1A for simplification
- ✓ 1CA for correct answer

✓ 9²

✓ 81

✓ 3⁻⁶

✓ 81

(2)

$$1.1.2 \quad \frac{5^{2-m} \cdot 2^m \cdot 5^m}{2^{m-1}}$$

$$= 5^{2-m+m} \cdot 2^{m-m+1}$$

$$= 5^2 \cdot 2$$

$$= 50$$

- ✓ Same bases

✓ 5² · 2

✓ 50

(3)

$$1.1.3 \quad \frac{2^x(5 \cdot 2^x - 1)}{2^x(2^x)}$$

$$= \frac{9}{2}$$

$$= 18$$

- ✓ Factorising

- ✓ Simplifying

✓ 18

(5)

1.2
$$\frac{9-3\sqrt{6}}{6\sqrt{2}}$$

$$\frac{3(3-\sqrt{6})}{6\sqrt{2}}$$

$$= \frac{3-\sqrt{6}}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

$$= \frac{3\sqrt{2}-2\sqrt{3}}{4}$$

$$\text{L.H.S} = \frac{9-3\sqrt{6}}{6\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

$$= \frac{9\sqrt{2}-3\sqrt{12}}{12}$$

$$= \frac{3(3\sqrt{2}-2\sqrt{3})}{12}$$

$$= \frac{3\sqrt{2}-2\sqrt{3}}{4} = \text{RHS}$$

QUESTION TWO

2.1

2.1.1 $x=0$ or $x=\frac{1}{2}$

2.1.2 $5x^2 - 3x - 4 = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-3) \pm \sqrt{(-3)^2 - 4(5)(-4)}}{2(5)}$$

$= 1,24$ or $-0,64$

2.1.3 $\sqrt{7x+2} = 2x$

$7x + 2 = 4x^2$

$4x^2 - 7x - 2 = 0$

$(4x+1)(x-2) = 0$

$x = -\frac{1}{4}$ or 2

SS = {2}

✓✓ Answer (2)

✓ 1M for correct formula

✓ 1A for substitution

✓ 2CA for each value of x (4)

✓ 1A for squaring both sides

✓ 1CA for correct factorization

✓ 1CA for both values of x

✓ 1CA for correct solution (4)

✓ 1CA for factorisation

✓ 1CA for rationalising

✓ 1CA for correct simplification

✓ Rationalising

✓ Multiplying

✓ Factorising

(3)

[11]

2.2 $x = 6 - y$

$$(6-y)^2 + 2y(6-y) - 8y^2 = 0$$

$$36 - 12y + y^2 + 12y - 2y^2 - 8y^2 = 0$$

$$-9y^2 + 36 = 0$$

$$y^2 - 4 = 0$$

$$(y-2)(y+2) = 0$$

$$y = 2 \text{ or } y = -2$$

$$x = 4 \text{ or } x = 8$$

OR $y = 6 - x \rightarrow (3)$

$$x^2 + 2x(6-x) - 8(6-x)^2 = 0$$

$$x^2 + 12x - 2x^2 - 8(36 - 12x + x^2) = 0$$

$$-x^2 + 12x - 288 + 96x - 8x^2 = 0$$

$$-9x^2 + 108x - 288 = 0$$

$$x^2 - 12x + 32 = 0$$

$$(x-4)(x-8) = 0$$

$$x = 4 \text{ or } x = 8$$

$$y = 2 \text{ or } y = -2$$

2.3

$$-2x(x-3) \leq 4$$

$$-2x^2 + 6x - 4 \leq 0$$

$$x^2 - 3x + 2 \geq 0$$

$$(x-2)(x-1) \geq 0$$

CVs $x = 2$ or $x = 1$

$$\frac{+}{1} \quad - \quad \frac{+}{2}$$

SS $x \in \mathbb{R}, \{x \geq 2\} \cup \{x \leq 1\}$

2.4

2.4.1 $m + 6 < 0$
 $m < -6$

2.4.2 $x^2 - 5x + p = 0$
 $b^2 - 4ac \geq 0$
 $(-5)^2 - 4(1)(p) \geq 0$
 $25 - 4p \geq 0$
 $-4p \geq -25$
 $p \leq \frac{25}{4}$ or $6\frac{1}{4}$

✓ $m + 6 < 0$
 ✓ Answer

✓ 1A for ≥ 0
 ✓ 1A for correct substitution

✓ ICA for correct answer
 [25]

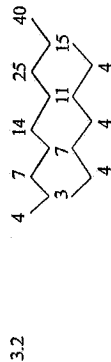
(2)

(3)

[25]

QUESTION THREE

3.1 $m = 40$



$2a = 4$

$a = 2$

$3a + b = 3$

$b = -3$

$a + b + c = 4$

$c = 5$

$T_n = 2n^2 - 3n + 5$

3.3 T_n of 1st difference = $4n - 1$

$T_n - T_{n-1} = 87$

$4n - 1 = 87$

$n = 22$

$\therefore T_{22} - T_{21} = 87$

$T_{22} = 2(22)^2 - 3(22) + 5 = 907$

$T_{23} = 2(23)^2 - 3(23) + 5 = 994$

OR

$T_n = 4n - 1$

$87 = 4n - 1$

$22 = n$

The 22nd and the 23rd terms

3.4 $T_n = 4855$

$2n^2 - 3n + 5 = 4855$

$2n^2 - 3n - 4850 = 0$

$(2n + 97)(n - 50) = 0$

$\therefore n = 50$

QUESTION FOUR

4.1 $C = \left(\frac{6+4}{2}; \frac{-5+5}{2} \right)$
 $= \left(\frac{10}{2}; \frac{0}{2} \right)$
 $= (5; 0)$

✓ 1A for 5 and ✓ 1A for 0 (2)

4.2 $m_{PD} = \frac{1 - (-5)}{-6 - 6}$
 $= \frac{6}{-12}$
 $= -\frac{1}{2}$

✓ 1A for correct substitution

✓ 1CA for correct answer (2)

4.3 $y = mx + c$

$1 = -\frac{1}{2}(-6) + c$ OR $-5 = -\frac{1}{2}(6) + c$

✓ 1A for correct substitution

$c = -2$

✓ 1CA for correct value of c

$y = -\frac{1}{2}x - 2$

✓ 1CA for correct equation

OR $y - y_1 = m(x - x_1)$
 $y - 1 = \frac{-1}{2}x(x + 6)$

✓ 1A for correct substitution

$y - 1 = \frac{-1}{2}x - 3$

✓ 1A for simplification

$y = -\frac{1}{2}x - 2$

✓ 1CA for correct answer

OR $y + 5 = \frac{-1}{2}(x - 6)$

✓ 1A for correct substitution

$y + 5 = \frac{-1}{2}x + 3$

✓ 1CA for simplification

$y = -\frac{1}{2}x - 2$

✓ 1CA for correct answer (3)

✓ 2A for correct answer (2)

✓ 1A for finding the difference

✓ a-value

✓ b-value

✓ c-value

✓ Answer (4)

✓ $T_n = 87$

✓ $n = 22$

✓ T_{22} value

✓ T_{23} value

✓ 1CA for finding the nth term of the first difference

✓ 1CA for correct substitution

✓ 1CA for each term (4)

✓ $T_n = 4855$

✓ Standard form

✓ 1CA for correct factorization

✓ 1CA for correct answer (4) [14]

$$\begin{aligned}
 4.4 \quad PR &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\
 &= \sqrt{(4 + 6)^2 + (5 - 1)^2} \\
 &= \sqrt{116} \\
 &= 2\sqrt{29}
 \end{aligned}$$

$$\begin{aligned}
 4.5 \quad B &= (0; -2) \text{ and } C = (5; 0) \\
 \therefore BC &= \sqrt{(5 - 0)^2 + (0 + 2)^2} \\
 &= \sqrt{29} \\
 \therefore PR &= 2 BC
 \end{aligned}$$

$$\begin{aligned}
 4.6 \quad B &= (0; -2) \\
 C &= (5; 0) \\
 M_{BC} &= \frac{5}{2} \\
 M_{PR} &= \frac{4}{10} = \frac{2}{5}
 \end{aligned}$$

$\therefore BC \parallel PR$ (equal gradients)

$$\begin{aligned}
 4.7 \quad \tan \theta &= m \\
 \tan \theta &= -5 \quad [RA = 78,7^\circ] \\
 \theta_1 &= 101,3^\circ \\
 \tan \theta &= m \\
 \tan \theta &= \frac{3}{2} \quad [RA = 26,6^\circ] \\
 \therefore \theta_1 &= 153,4^\circ \\
 \therefore \alpha &= 52,1^\circ
 \end{aligned}$$

$$\begin{aligned}
 4.8 \quad M_{PQ} &= \frac{-1}{2} \\
 \therefore M \perp \text{ a line } &= 2 \\
 y &= mx + c \quad (-6; 1) \\
 1 &= 2(-6) + c \\
 c &= 13 \\
 \therefore y &= 2x + 13
 \end{aligned}$$

- ✓ 1M for formula
- ✓ 1A for correct substitution
- ✓ 1CA for correct answer (3)
- ✓ 1A for co-ordinates of B
- ✓ 1CA for correct substitution
- ✓ 1CA for correct answer (3)
- ✓ 1CA for gradient of BC
- ✓ 1CA for gradient PR
- ✓ Equal gradients (3)
- ✓ 1A for 78,7°
- ✓ 1CA for 101,3°
- ✓ 1A for 26,6°
- ✓✓ 2CA for correct answer (5)
- ✓ 1A for gradient
- ✓ 1CA for correct substitution
- ✓ 1CA for c value
- ✓ 1CA for correct answer (4)

TOTAL MARKS: 75 [25]

