



NATIONAL SENIOR CERTIFICATE EXAMINATION  
NOVEMBER 2024

**MATHEMATICS: PAPER I  
MARKING GUIDELINES**

Time: 3 hours

150 marks

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**These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.**

**The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.**

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**SECTION A****QUESTION 1**

$$(a) \quad (1) \quad \left(\frac{x}{4} - 1\right)(x + 2) = 0$$

$$x = 4 \quad \text{or} \quad x = -2$$

$$(2) \quad 2x^2 - x - 12 = 0$$

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

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

$$x = \frac{1 \pm \sqrt{(-1)^2 - 4(2)(-12)}}{2(2)}$$

$$x = -2, 71 \quad \text{or} \quad x = 2, 71$$

$$(3) \quad x^2 + 2x \leq 0$$

$$x^2 + 2x \leq 0$$

$$x(x + 2) \leq 0$$

$$CV : x = 0 \quad \text{and} \quad x = -2$$

$$\therefore -2 \leq x \leq 0$$

|                                                                                                                                                                                                                                 |            |                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| $(b) \quad x\left(\frac{1}{2}x + 2\right) = -k^2$ $\frac{1}{2}x^2 + 2x + k^2 = 0$ $\Delta = b^2 - 4ac$ $0 = (2)^2 - 4\left(\frac{1}{2}\right)(k^2)$ $0 = 4 - 2k^2$ $2k^2 = 4$ $k^2 = 2$ $k = \pm\sqrt{2}$ $(\text{two values})$ | <p>ALT</p> | $x^2 + 4x + 2k^2 = 0$ $\Delta = b^2 - 4ac$ $= (4)^2 - 4(1)(2k^2)$ $0 = 16 - 8k^2$ $8k^2 = 16$ $k^2 = 2$ $k = \pm\sqrt{2}$ $(\text{two values})$ |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------|

**QUESTION 2**

(a)  $3^{x+2y} = \frac{9^{3y}}{27}$

$$3^{x+2y} = \frac{3^{6y}}{3^3}$$
$$3^{x+2y} = 3^{6y-3} \quad (\text{same base})$$
$$x + 2y = 6y - 3$$
$$x = 4y - 3$$

(b)  $\sqrt{x+8} - x = 2$

$$\sqrt{x+8} = 2 + x$$
$$x + 8 = (x + 2)^2$$
$$x + 8 = x^2 + 4x + 4$$
$$0 = x^2 + 3x - 4$$
$$0 = (x + 4)(x - 1)$$
$$x \neq -4 \quad \text{or} \quad x = 1$$

(c) (1)  $\log 6 + \log 3$   
 $= x + y$

(2)  $\log 3^{\frac{1}{2}}$   
 $= \frac{1}{2} \log 3$   
 $= \frac{1}{2} y$

(3)  $\log \frac{6}{3}$   
 $= \log 6 - \log 3$   
 $= x - y$

**QUESTION 3**

(a)  $f(x) = x^2 + 1$

$$\begin{aligned}
 f'(x) &= \lim_{h \rightarrow 0} \frac{(x+h)^2 + 1 - (x^2 + 1)}{h} \\
 &= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 + 1 - x^2 - 1}{h} \\
 &= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h} \\
 &= \lim_{h \rightarrow 0} \frac{h(2x + h)}{h} \\
 &= 2x \checkmark
 \end{aligned}$$

notation

(b)

$$\begin{aligned}
 f(x) &= 2x^4 + \frac{1}{\sqrt[4]{x}} - 4 \\
 &= 2x^4 + x^{-\frac{1}{4}} - 4 \\
 f'(x) &= 8x^3 - \frac{1}{4}x^{-\frac{5}{4}}
 \end{aligned}$$

(c) (1)  $x^2 - 3x - 4 = 0$   
 $(x-4)(x+1) = 0$   
 $x = 4$  of  $x = -1$   
 $A(-1; 0)$  en  $B(4; 0)$

(2) Determine the coordinates of D

|                                                       |                                                       |
|-------------------------------------------------------|-------------------------------------------------------|
| $f'(x) = 2x - 3$                                      | ALT $x = -\frac{(-3)}{2(1)}$                          |
| $x = \frac{3}{2}$                                     | $x = \frac{3}{2}$                                     |
| $f\left(\frac{3}{2}\right) = -\frac{25}{4}$           | $f\left(\frac{3}{2}\right) = -\frac{25}{4}$           |
| $\therefore D\left(\frac{3}{2}; -\frac{25}{4}\right)$ | $\therefore D\left(\frac{3}{2}; -\frac{25}{4}\right)$ |

$$(3) \quad x < \frac{3}{2}$$

$$(4) \quad m = -4$$

$$2x - 3 = -4$$

$$2x = -1$$

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

#### QUESTION 4

$$\begin{aligned} (a) \quad (3x+1) - (5x-1) &= 2x - (3x+1) \checkmark \checkmark \\ -2x + 2 &= -x - 1 \\ -x &= -3 \\ x &= 3 \\ 14; 10; 6 \end{aligned}$$

$$\begin{aligned} (b) \quad T_n &= a + (n-1)d \\ &= 14 + (n-1)(-4) \\ &= 18 - 4n \end{aligned}$$

**QUESTION 5**

(a)  $f(x) = x^3 + px^2 + 3x - 9$  sub  $E\left(-\frac{5}{3}; y\right)$

$$f'(x) = 3x^2 + 2px + 3$$

$$f''(x) = 6x + 2p$$

$$0 = 6\left(-\frac{5}{3}\right) + 2p$$

$$p = 5$$

(b) (1)  $f(x) = x^3 + 5x^2 + 3x - 9$

$$f(x) = x^3 + 5x^2 + 3x - 9$$

$$f'(x) = 3x^2 + 10x + 3$$

$$0 = 3x^2 + 10x + 3$$

$$0 = (3x + 1)(x + 3)$$

$$x = -3 \quad \text{or} \quad x = -\frac{1}{3}$$

$$f\left(-\frac{1}{3}\right) = \left(-\frac{1}{3}\right)^3 + 5\left(-\frac{1}{3}\right)^2 + 3\left(-\frac{1}{3}\right) - 9$$

$$= -\frac{256}{27}$$

$$C\left(-\frac{1}{3}; -\frac{256}{27}\right) \quad \text{ALT} \quad C\left(-\frac{1}{3}; -9\frac{13}{27}\right)$$

(2)  $0 = x^3 + 5x^2 + 3x - 9$

$$0 = (x - 1)(x + 3)^2$$

$$x = 1 \quad \text{of} \quad x = -3$$

$$B(1; 0)$$

**QUESTION 6**

$$(a) \quad 1+i_{\text{eff}} = \left(1+\frac{i}{n}\right)^n$$

$$1+i_{\text{eff}} = \left(1+\frac{0,06}{4}\right)^4$$

$$i_{\text{eff}} = 0,06136$$

Rond af na 2 desimale plekke in V6(a).

$$\therefore i_{\text{eff}} = 6,14\% \text{ p.a.}$$

$$(b) \quad (1) \quad \text{Deposit} = \text{R}235\,000$$

$$705\,000 = \frac{x \left[ 1 - \left( 1 + \frac{0,1125}{12} \right)^{-20 \times 12} \right]}{\frac{0,1125}{12}} \quad \text{Incorrect formulae maxim in is Y-i deposit}$$

$$x = 7\,397,25$$

$$(2) \quad B.O = 705\,000 \left( 1 + \frac{0,1125}{12} \right)^{11 \times 12} - \frac{7\,397,25 \left[ \left( 1 + \frac{0,1125}{12} \right)^{11 \times 12} - 1 \right]}{\frac{0,1125}{12}}$$

$$= 501\,020,53$$

compound is correct – Present value

705 000 must be next to the correct bracket

ALT

$$B.O = 7\,397,25 \frac{\left[ 1 - \left( 1 + \frac{0,1125}{12} \right)^{-108} \right]}{\frac{0,1125}{12}}$$

$$= 501\,018,93$$

**SECTION B****QUESTION 7**

(a)

$$\begin{array}{ccccccc} 3 & ; & 9 & ; & 17 & ; & 27 & ; & 39; \dots \\ & & 6 & & 8 & & 10 & & 12 \\ & & & & 2 & & 2 & & 2 \end{array}$$

$$2a = 2$$

$$a = 1$$

$$3a + b = 6$$

$$3 + b = 6$$

$$b = 3$$

$$a + b + c = 3$$

$$1 + 3 + c = 3$$

$$c = -1$$

$$\therefore T_n = n^2 + 3n - 1$$

(b)

$$T_n = n^2 + 3n - 1$$

$$n^2 + 3n - 1 = 161$$

$$n^2 + 3n - 162 = 0$$

$$\Delta = b^2 - 4ac$$

$$\text{ALT } n^2 + 3n - 162 = 0$$

$$= (3)^2 - 4(1)(-162)$$

$$= 657$$

Roots : Irrational and unequal

Tlhogi is incorrect.

$$n = -\frac{3 \pm \sqrt{3^2 - 4(1)(-162)}}{2}$$

$$n = 14,32 \quad \text{or} \quad n = -11,32$$

Tlhogi is incorrect.

**QUESTION 8**

(a) (1)  $1 + \left(\frac{x+2}{2}\right)^1 + \left(\frac{x+2}{2}\right)^2 + \dots$

(2)  $-1 < r < 1$  and

$$-1 < \left(\frac{x+2}{2}\right) < 1$$

$$-2 < x+2 < 2$$

$$-4 < x < 0$$

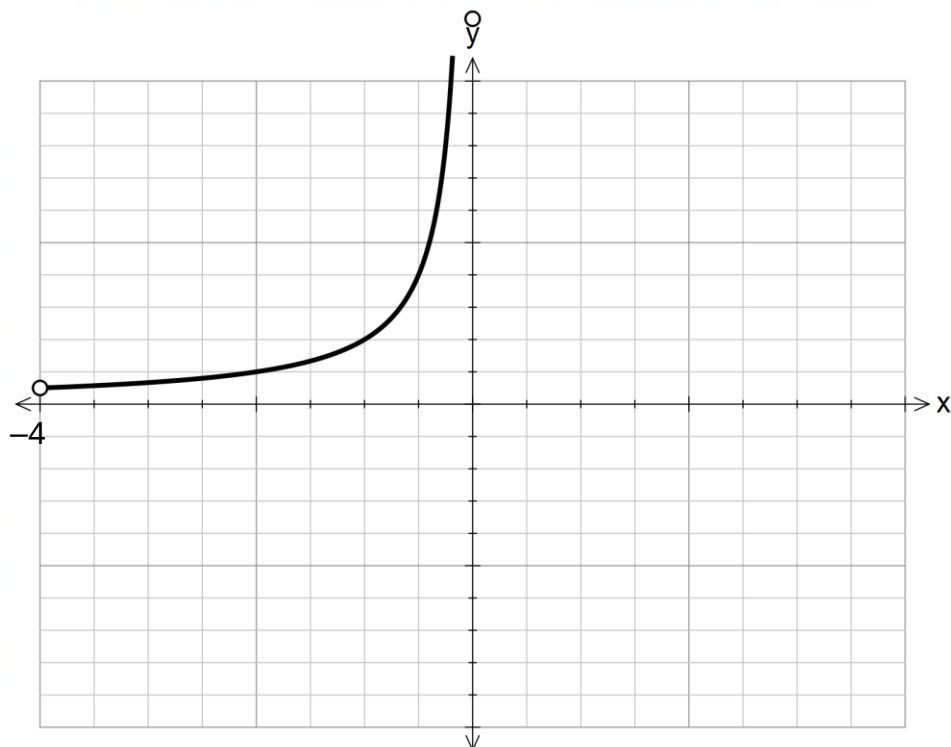
(3)  $1 + \left(\frac{x+2}{2}\right)^1 + \left(\frac{x+2}{2}\right)^2 + \dots$

$$S_{\infty} = \frac{1}{1 - \left(1 + \frac{x}{2}\right)}$$

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

(4) Shape restriction asymptote

Show a point that lies on the curve or implied



$$\begin{aligned}
 \text{(b)} \quad (1) \quad 0 &= -\frac{20}{11449}x^2 + 20 \\
 x &= \pm 107 \\
 x &= 107 \\
 \therefore a &= 107
 \end{aligned}$$

$$\begin{aligned}
 (2) \quad r &= \frac{2}{3} \\
 \text{diameter} &= 36 \text{ P} \\
 \pi r^2 &= 324 \\
 r &= 18
 \end{aligned}$$

$$S_n = 36 + 24 + 16 + \dots$$

$$S_n < 107$$

$$\frac{36 \left[ \left( \frac{2}{3} \right)^n - 1 \right]}{\frac{2}{3} - 1} < 107$$

$$\left( \frac{2}{3} \right)^n > \frac{1}{108}$$

$$n < 11.5$$

$$\therefore n = 11$$

$$\text{ALT} \quad \frac{36 \left[ \left( \frac{2}{3} \right)^n - 1 \right]}{\frac{2}{3} - 1} = 107$$

$$\left( \frac{2}{3} \right)^n = \frac{1}{108}$$

$$n = 11,55$$

$$\therefore n = 11$$

**QUESTION 9**

(a) (1)  $x \in \mathbb{R} \quad x \neq 2$

(2)  $f(x) = a(x-2)^2 + 3 \quad \text{sub}(3;5)$

$$5 = a(3-2)^2 + 3$$

$$5 = a + 3$$

$$a = 2$$

$$f(x) = 2(x-2)^2 + 3$$

(3)  $g(x) = \frac{k}{x-2} + 3 \quad \text{sub}(3;5)$

$$5 = \frac{k}{3-2} + 3$$

$$k = 2$$

$$g(x) = \frac{2}{x-2} + 3$$

$$f(x) = 2(x-2)^2 + 3$$

$$AB = 2(0-2)^2 + 3 - \left[ \frac{2}{0-2} + 3 \right]$$

$$= 11 - 2$$

$$= 9$$

(4)  $0 = \frac{2}{x-2} + 3$

$$0 = 2 + 3x - 6$$

$$-3x = -4$$

$$x = \frac{4}{3}$$

$$x < \frac{4}{3} \quad \text{of} \quad x > 2$$

$$(b) \quad h\left(\frac{31}{10}\right) = -1$$

$$\log_k(4 + m) = 0$$

$$4 + m = k^0$$

$$4 + m = 1$$

$$m = -3$$

$$-1 = \log_k\left(\frac{31}{10} - 3\right)$$

$$\log_k\left(\frac{1}{10}\right) = -1$$

$$\frac{1}{10} = k^{-1}$$

$$10 = k$$

ALT

$$\log_k(4 + m) = 0$$

$$4 + m = k^0$$

$$4 + m = 1$$

$$m = -3$$

$$\log_k(y + m) = x$$

$$y = k^x - m$$

$$\frac{31}{10} = k^{-1} + 3$$

$$\frac{1}{k} = \frac{1}{10}$$

$$k = 10$$

**QUESTION 10**

(a)  $f'(x) = 2x - 14$

$f'(8) = 2$

$f(8) = -5$

$y = 2x + c \quad \text{sub } (8; -5)$

$-5 = 2(8) + c$

$c = -21$

$y = 2x - 21$

ALT  $y + 5 = 2(x - 8)$

$y + 5 = 2x - 16$

$y = 2x - 21$

(b)  $g'(x) = -2x + 10$

if the diff  $f(x)=2$  and equal slope then BD (Zero)

$-2x + 10 = 2$

$x = 4$

$B(4; -13)$

$g(x) = -x^2 + 10x - 19 + k \quad \text{sub } B(4; -13)$

$-13 = -(4)^2 + 10(4) - 19 + k$

$k = -18$

**QUESTION 11**

$$3OG = EF = 2OE \quad \text{or} \quad \frac{OG}{OE} = \frac{2}{3}$$

$$y = -\frac{2}{3}x + \frac{2}{3}k \quad \text{ALT if } B(x;y) \text{ then } \frac{y}{k-x} = \frac{2}{3} \quad \therefore y = \frac{2}{3}(k-x)$$

$$A = 2x.y$$

$$A = 2x \left( -\frac{2}{3}x + \frac{2}{3}k \right)$$

$$= -\frac{4}{3}x^2 + \frac{4}{3}xk$$

$$\frac{dA}{dx} = -\frac{8}{3}x + \frac{4}{3}k = 0$$

$$8x = 4k$$

$$x = \frac{1}{2}k$$

$$A = 2 \cdot \frac{1}{2}k \left( -\frac{2}{3} \cdot \frac{1}{2}k + \frac{2}{3}k \right)$$

$$= k \left( -\frac{1}{3}k + \frac{2}{3}k \right)$$

$$= \frac{1}{3}k^2$$

**QUESTION 12**

(a) (1)  $10 \times 9 \times 8 \times 7$   
 $9 \times 8 \times 7 \times 6$   
 $10!/6!$   
 $10P4$

(2) Exactly two 9s in the PIN

$$\begin{array}{cccc}
 9 & 9 & - & - \\
 - & - & 9 & 9 \\
 9 & - & - & 9 \\
 - & 9 & - & 9 \\
 9 & - & - & 9 \\
 - & 9 & 9 & -
 \end{array}$$

for cases

$$\therefore 6 \times 9 \times 9$$

$= P$  (Exactly two 9s in the PIN)

$$\begin{aligned}
 &= \frac{6 \times 9 \times 9}{10 \times 10 \times 10 \times 10} \\
 &= \frac{243}{5000} \quad \text{or} \quad 0,05
 \end{aligned}$$

(n(s) must make sense  $9^4$  something with 4 position to get  $P(A)$  )

ALT

Two 9s in 4 positions:

$$4C_2 = 6$$

$$\therefore (1 \times 1 \times 9 \times 9) \times 6$$

$= P$  (Exactly two 9s in the PIN)

$$\begin{aligned}
 &= \frac{(1 \times 1 \times 9 \times 9) \times 6}{10 \times 10 \times 10 \times 10} \\
 &= \frac{243}{5000} \quad \text{or} \quad 0,05
 \end{aligned}$$

$$(b) \quad 4\left(\frac{1}{4}\right) = 5P(A \cap B) \checkmark$$

$$P(A \cap B) = \frac{1}{5}$$

$$y = \frac{1}{5} \times 80$$

$$= 16$$

$$z + y = 20$$

$$z = 4$$

Slegs A is 24

$$x + z = 40$$

$$x = 36$$

ALT

$$P(A) = \frac{1}{2} \quad \therefore n(A) = 40 \quad \therefore x + 40 + z = 80$$

Slegs A is 24

$$x + z = 40 \qquad y = 16 \qquad z = 4$$

$$x = 36$$

ALT

$$4(y + z) = 5y \quad \therefore y = 4z \quad \text{and} \quad y + z = 20 \quad \text{but} \quad x + z = 40$$

$$\text{Hence } 5z = 20$$

$$\therefore z = 4$$

$$y = 16$$

$$x + z = 40$$

$$\therefore x = 36$$

**Total: 150 marks**