
MEMORANDUM

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GRADE 11 EXAMINATIONS
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MATHEMATICS – SECOND PAPER

This memorandum consists of 11 pages.

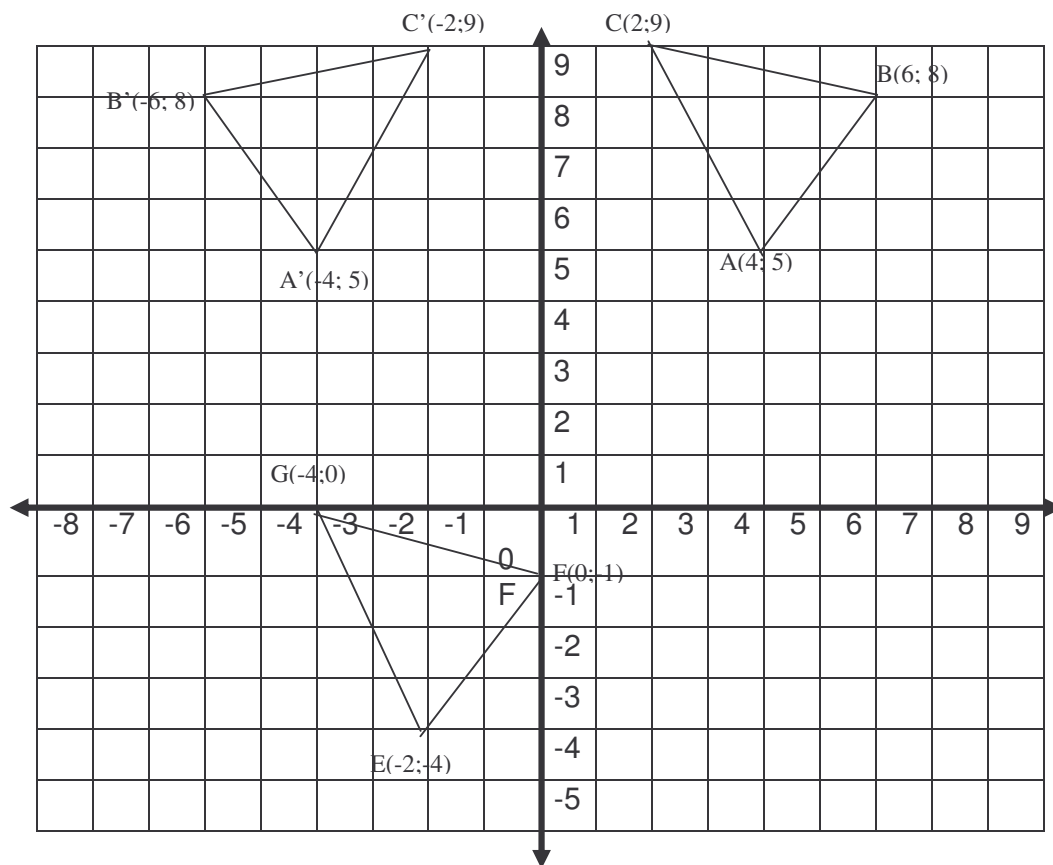
QUESTION 1

1.1	$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(-4 - 1)^2 + (8 + 4)^2}$ $= \sqrt{25 + 144}$ $= \sqrt{169} = 13$	✓ formula ✓ substitution ✓ answer (3)
1.2	$\text{Gradient of AB} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{8 - (-4)}{-4 - 1} = -\frac{12}{5}$	✓ formula ✓ substitution ✓ answer (3)
1.3	$\tan \theta = m$ $= -\frac{12}{5}$ $\theta = 180^\circ - 67,3801$ $= 112,6^\circ$	✓ $\tan \theta = -\frac{12}{5}$ ✓ ref. angle ✓ answer (3)
1.4	$\text{Equation of AB : } y - y_1 = m(x - x_1)$ $y - (-4) = -\frac{12}{5}(x - 1)$ $y + 4 = -\frac{12}{5}x + \frac{12}{5}$ $y = -\frac{12}{5}x - \frac{8}{5}$	✓ formula ✓ substitution ✓ answer (3)
1.5	Coordinates of C: $(0; -\frac{8}{5})$	✓ ✓ answer (2)
1.6	$\text{Midpoint of AB} = \left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2} \right)$ $\left(\frac{-4 + 1}{2}; \frac{8 - 4}{2} \right) = \left(\frac{-3}{2}; 2 \right)$ $\therefore \text{The coordinates of C} \left(0; -\frac{8}{5} \right) \neq \left(\frac{-3}{2}; 2 \right)$ $\therefore \text{C is not the midpoint of AB}$	✓ formula ✓ substitution ✓ $\left(\frac{-3}{2}; 2 \right)$ ✓ conclusion (4) [18]

QUESTION 2

2.1.1	Midpoint of PR : $M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$ $= M\left(\frac{-4+2}{2}; \frac{3+5}{2}\right) = M(-1; 4)$	✓ substitution ✓ answer (2)
2.1.2	$m_{PR} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5-3}{2-(-4)} = \frac{2}{6} = \frac{1}{3}$ $m_{MQ} = \frac{4-(-2)}{-1-1} = \frac{6}{-2} = -3$ $m_{PR} \cdot m_{MQ} = \frac{1}{3} \times (-3) = -1$ $\therefore PR \perp QM$ Product of gradients = -1	✓ $\frac{1}{3}$ ✓ -3 ✓ -1 ✓ conclusion (4)
2.1.3	Area = $\frac{1}{2}bh$ Area of $\Delta RMQ = \frac{1}{2}\left(\frac{1}{2} \times PR \times MQ\right)$ $PR = \sqrt{(-4-2)^2 + (5-3)^2} \quad MQ = \sqrt{(-1-1)^2 + (4+2)^2}$ $= \sqrt{40} \quad \quad \quad = \sqrt{40}$ Area of $\Delta RMQ = \frac{1}{2} \times \frac{1}{2} \times \sqrt{40} \times \sqrt{40}$ $= \frac{1}{4} \times 40 = 10 \text{ unit}^2$	✓ $PR = \sqrt{40}$ ✓ $MQ = \sqrt{40}$ ✓ substitution ✓ answer (4)
2.2	$2y - 3x + 7 = 0$ $y = \frac{3}{2}x - \frac{7}{2}$ gradient of the line = $\frac{3}{2}$ gradient of the parallel line is $\frac{3}{2}$ Equation of the parallel line is $y - y_1 = m(x - x_1)$ Substituting (2; -4) $y + 4 = \frac{3}{2}(x - 2) \quad y = \frac{3}{2}x - 7$	✓ gradient ✓ gradient of parallel line $\frac{3}{2}$ ✓ substitution (2; -4) ✓ answer (4)
2.3	$m_{AB} = m_{BC}$ OR $M_{AB} = \frac{1}{2}$ $\frac{0 - (-1)}{-2 - (-4)} = \frac{p - 0}{2 - (-2)} \quad y = \frac{1}{2}(x+2)$ $\frac{1}{2} = \frac{p}{4} \quad p = 2 \quad y = \frac{1}{2}x + 1$ Subst (2;p) $p = \frac{1}{2} \cdot 2 + 1$ $= 2$	✓ $m_{AB} = m_{BC}$ ✓ substitution ✓ answer (4) [18]

QUESTION 3



3.1.1	A'(-4;5) B'(-6;8) C'(-2;9)	✓✓✓	(3)
3.1.2	E(-2;- 4) F(0;-1) G(- 4;0)	✓✓✓	(3)
3.1.3	D(-8;-6)	✓✓	(2)
3.1.4	Rotation clockwise around origin through 90°	✓rotation ✓clockwise around origin ✓ 90°	(3)
3.1.5	(-4;-5)	✓✓	(2)
3.2.1	Scale factor = 2	✓	(1)
3.2.2	P" $\left(1; \frac{2}{3}\right)$ Q" $\left(\frac{4}{3}; \frac{5}{3}\right)$ R" $\left(\frac{7}{3}; 1\right)$	✓✓✓	(3)

[17]

QUESTION 4

4.1.1	$\begin{aligned} OP^2 &= (-5)^2 + 12^2 \\ &= 25 + 144 \\ &= 169 \\ OP &= 13 \end{aligned}$	✓ Applying Pythagoras theorem ✓ answer (2)
4.12	$\begin{aligned} \tan(180^\circ + \alpha) &= \tan \alpha \\ &= -\frac{12}{5} \end{aligned}$	✓ $\tan \alpha$ ✓ answer (2)
4.1.3	$\begin{aligned} \beta &= \alpha - 90^\circ \\ \sin \beta &= \sin(\alpha - 90^\circ) = \sin(-(90^\circ - \alpha)) \\ &= -\sin(90^\circ - \alpha) \\ &= -\cos \alpha = -\left(-\frac{5}{13}\right) \\ &= \frac{5}{13} \end{aligned}$	✓ $\beta = \alpha - 90^\circ$ ✓ $-\sin(90^\circ - \alpha)$ ✓ $-\cos \alpha$ ✓ answer (4)
4.2.1	$\begin{aligned} \text{LHS} &= \sin x \cdot \cos x \cdot \frac{\sin x}{\cos x} \\ &= \sin^2 x \\ &= 1 - \cos^2 x = \text{RHS} \end{aligned}$	✓ $\frac{\sin x}{\cos x}$ ✓ $\sin^2 x$ ✓ $1 - \cos^2 x$ (3)
4.2.2	$\begin{aligned} \text{RHS} &= \frac{\sin^2 y}{1 - \cos y} = \frac{1 - \cos^2 y}{1 - \cos y} \\ &= \frac{(1 + \cos y)(1 - \cos y)}{1 - \cos y} \\ &= 1 + \cos y = \text{LHS} \end{aligned}$	✓ $1 - \cos^2 y$ ✓ factors ✓ simplification (3) [14]

QUESTION 5

5.1	$= \frac{(-\sin \theta)(-\sin \theta)}{(-\sin \theta) \tan \theta}$ $= \frac{-\sin \theta}{\frac{\sin \theta}{\cos \theta}} = -\cos \theta$	✓ - sin θ ✓ - sin θ ✓ - sin θ ✓ tan θ ✓ $\frac{\sin \theta}{\cos \theta}$ ✓ answer (6)
5.2	$= \frac{(-\sin 40^\circ)(-\cos 30^\circ) \tan 45^\circ}{\sin 40^\circ (-\sin 60^\circ)(-1)}$ $= -\frac{\sqrt{3}}{2} \cdot 1 \quad OR \quad \frac{\sin 60^\circ \cdot 1}{\sin 60^\circ} OR \quad \frac{\cos 30^\circ \cdot 1}{\cos 30^\circ}$ $= -\frac{\sqrt{3}}{2}$ $= 1$	✓ - cos 30° ✓ sin 40° ✓ - sin 60° ✓ -1 ✓ $-\frac{\sqrt{3}}{2}$ ✓ 1 ✓ $-\frac{\sqrt{3}}{2}$ ✓ answer (8) [14]

QUESTION 6

6.1	$3 \tan \theta = 6$ $\tan \theta = 2$ $\theta = 180^\circ + 63,4349$ $= 243,43^\circ$	✓ tan θ = 2 ✓ reference angle ✓ 180° + 63,4349 ✓ answer (4)
6.2	$\sin 2x = 0 \quad \text{or} \quad \cos x = -\frac{1}{2}$ $2x = 0^\circ + 360^\circ \cdot k \quad x = 0^\circ + 180^\circ \cdot k$ $\text{or } 2x = 180^\circ + 360^\circ \cdot k \quad x = 90^\circ + 180^\circ \cdot k$ $\cos x = -\frac{1}{2} \quad x = 120^\circ + 360^\circ k \text{ or } x = 240^\circ + 360^\circ k$ $\text{where } k \in \mathbb{Z}$	✓ sin 2x = 0 or ✓ cos x = $-\frac{1}{2}$ ✓ 2x = 0° + 360° · k ✓ x = 0° + 180° · k ✓ 2x = 180° + 360° · k ✓ x = 90° + 180° · k ✓ x = 120° + 360° · k ✓ x = 240° + 360° · k ✓ k ∈ Z (9)

6.3.1	$p = 2$	✓ answer (1)
6.3.2	$x = -90^\circ ; 0^\circ ; 90^\circ ; 180^\circ$	✓✓ 1 mark per 2 values (2)
6.3.3	Minimum value of $f(x) = -1$	✓ answer (1)

[17]**QUESTION 7**

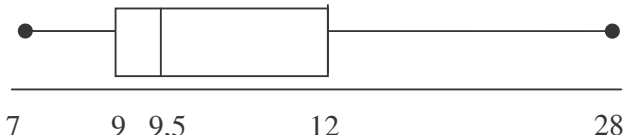
7.1	$\widehat{PRS} = 180^\circ - 35,1^\circ = 144,9^\circ \quad \text{and} \quad \widehat{RPS} = 11,7^\circ$ In $\triangle PRS$: $\frac{PS}{\sin 144,9^\circ} = \frac{RS}{\sin 11,7^\circ}$ $PS = \frac{RS \cdot \sin 144,9^\circ}{\sin 11,7^\circ}$ $= \frac{3,7 \cdot \sin 144,9^\circ}{\sin 11,7^\circ}$ $= 10,49 \text{ km}$	✓ $144,9^\circ$ and $11,7^\circ$ ✓ applying sine rule ✓ substitution ✓✓ answer (5)
7.2	Height of the mountain is PQ $\frac{PQ}{PS} = \sin 23,4^\circ$ $PQ = PS \cdot \sin 23,4^\circ$ $= 10,49 \cdot \sin 23,4^\circ$ $= 4,17 \text{ km}$	✓ $\frac{PQ}{PS} = \sin 23,4^\circ$ ✓ substitution ✓ answer (3)
7.3	Area of $\triangle PRS = \frac{1}{2} \cdot RS \cdot PS \cdot \sin 23,7^\circ$ $= \frac{1}{2} (3,7)(10,49) \sin 23,7^\circ$ $= 7,8 \text{ km}^2$	✓ area rule ✓ substitution ✓ answer (3)

[11]

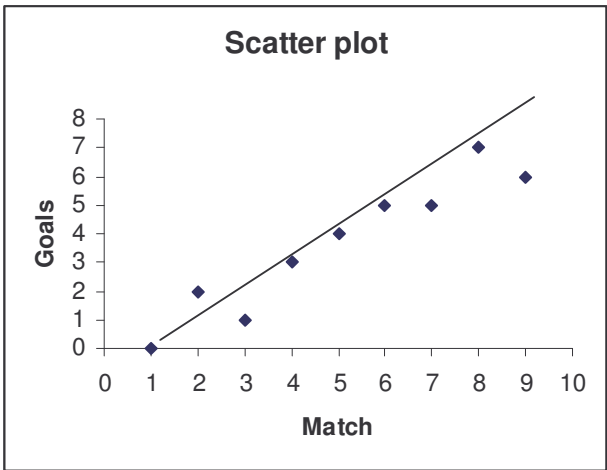
QUESTION 8

8.1	Slant height: $H^2 = h^2 + r^2$ $= 30^2 + 9^2$ $= 900 + 81$ $= 981$ $H = \sqrt{981}$ $= 31,3 \text{ mm}$	✓ Using Pythagoras theorem ✓ answer (2)
8.2	Exterior surface area = $\pi r^2 + \pi rH$ $= \pi \times 9 \times 9 + \pi \times 9 \times 31,3$ $= 1139,46\text{mm}^2$ Total exterior surface area = $2 \times 1139,46$ $= 2279\text{mm}^2$	✓ using formula ✓ substitution ✓ $1139,46\text{mm}^2$ ✓ answer (4)
8.3	Volume of the cone = $\frac{1}{3}\pi r^2 h$ $= \frac{1}{3} \times \pi \times 9 \times 9 \times 30$ $= 2544,7\text{mm}^3$ Volume of sand after 15 minutes = $\frac{2544,7\text{mm}^3}{4}$ $= 636,17\text{mm}^3$	✓ formula ✓ substitution ✓ $2544,7\text{mm}^3$ ✓ division by 4 ✓ answer (5) [11]

QUESTION 9

9.1.1	Mode = 9	✓ answer (1)
9.1.2	Arithmetic mean = $\frac{9 + 10 + 12 + 10 + 28 + 16 + 9 + 7 + 8 + 9 + 10}{10} = 11,8$	✓✓ answer (2)
9.1.3	7 8 9 9 9 10 10 12 16 28 Median = $\frac{9+10}{2} = 9,5$	✓order ✓ answer (2)
9.1.4	Lower quartile(Q_1) = 9 Upper quartile (Q_3) = 12	✓ 9 ✓ 12 (2)
9.1.5	Range = $28 - 7 = 21$	✓ 21 (1)
9.2	 Skewed to right / more spread out on right	✓✓ box ✓ whiskers ✓ comment (4) [12]

QUESTION 11

11.1		✓ axes and labels ✓✓ plotting points (3)
11.2	Linear	✓ answer (1)
11.3	See graph	✓ drawing (1)
11.4	9	✓ answer according to candidate's graph (1) [6]

Total: 150