Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

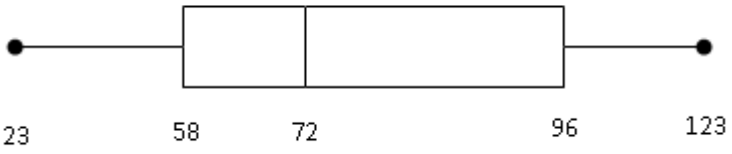
NOVEMBER 2010

MATHEMATICS – PAPER 2 MEMORANDUM

MARKS: 150

This memorandum consists of 14 pages.

QUESTION 1

1.1.1	Median = 72 ; $\frac{Q_3 - 58}{2} = 19$ $\therefore$ $Q_3 = 96$  	✓median = 72 ✓ $\frac{Q_3 - 58}{2} = 19$ ✓ $Q_3 = 96$ ✓ box with whiskers ✓ min and max values ✓ quartiles (6)
1.1.2	Data is positively skewed/ skewed to the right	✓answer. (1)
1.2	Standard deviation for Team A = 10,99 Team B = 19,94 $\therefore$ the scores for team B are more dispersed than those of team A	✓✓ st. dev for A ✓✓ st. dev for B ✓ conclusion (5)

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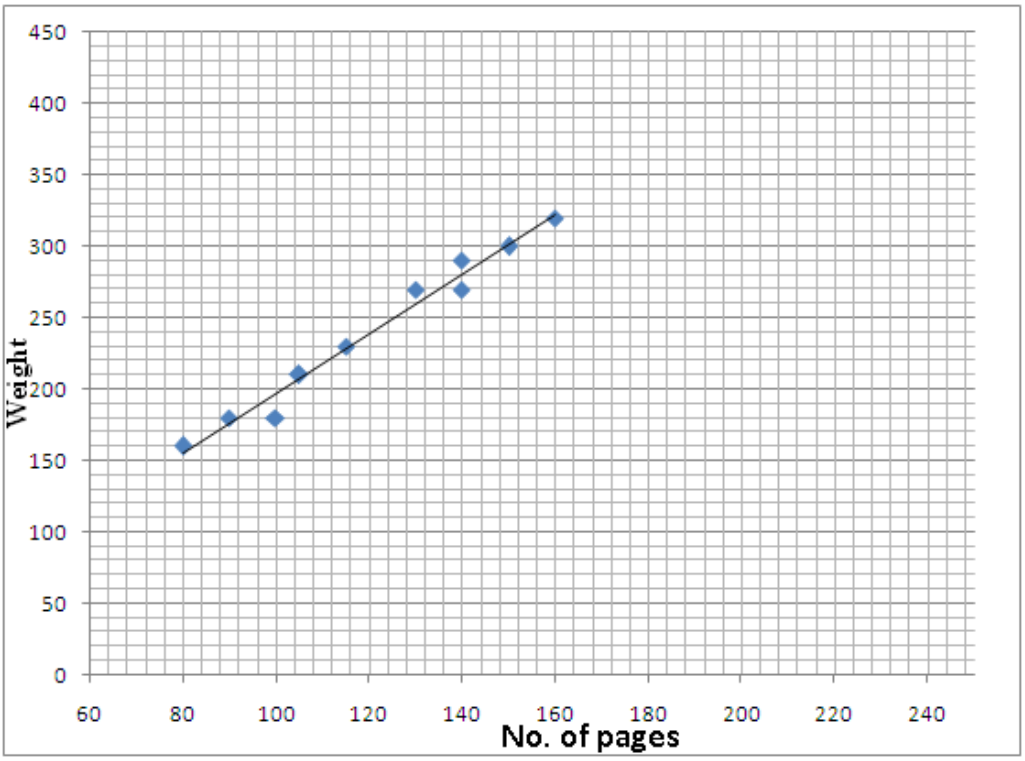
QUESTION 2

2.1.1



✓ axes names

All 10 points correct (2 marks)

Any 5 points correct (1 mark)

0 to 4 points (0 mark)

(3)

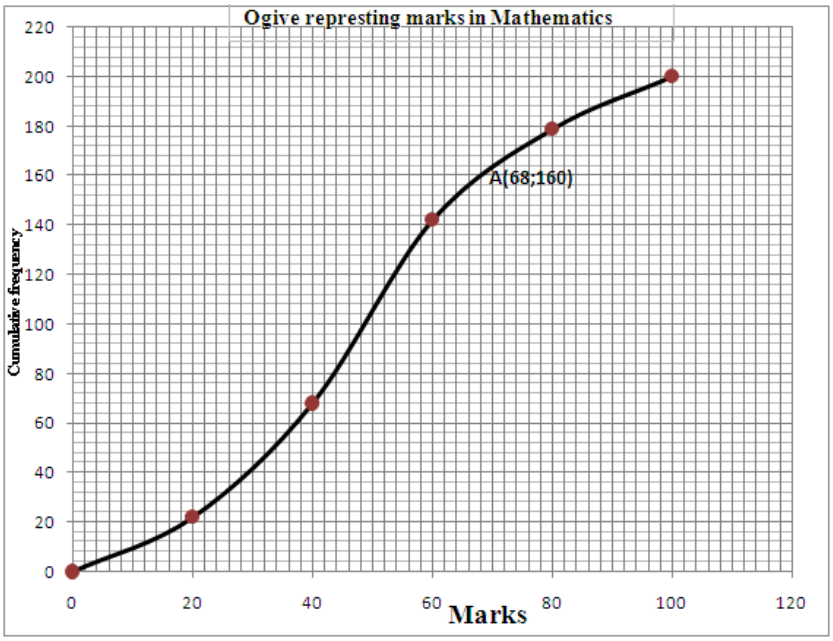
2.1.2	Positive relationship	✓ answer (1)
2.1.3	See graph in 2.1.1	✓✓ line of best fit (2)
2.1.4	2.1.4.1 140	✓ answer (1)
	2.1.4.2 400	✓ answer (1)

2.2.1

Marks	Frequency	Cum. Frequency
$0 \leq x < 20$	**22**	22
$20 \leq x < 40$	**46**	68
$40 \leq x < 60$	**74**	142
$60 \leq x < 80$	**37**	179
$80 \leq x < 100$	**21**	200

All 5 frequencies correct (2 marks)

2 to 4 frequencies correct(1 mark) (2)

2.2.2		✓Labels on the axes Plotting all 6 points correctly(2 marks) Plotting 3 to 5 points correctly (1 mark) Plotting 0 to 2 points (0 marks) ✓ curve (4)
2.2.3	See graph above A(68;160)	✓ A on graph ✓ 68 marks (2)

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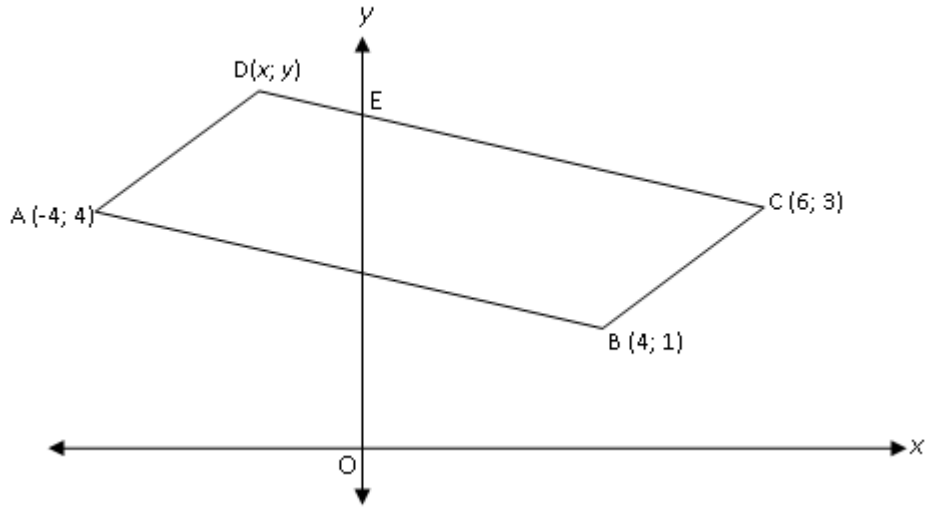
QUESTION 3



3.1	Gradient of AB: $\frac{y_2 - y_1}{x_2 - x_1} = \frac{4-1}{-4-4} = -\frac{3}{8}$ $\therefore$ $DC_m = -\frac{3}{8}$ $\therefore$ $y = -\frac{3}{8}x + c$ $\therefore$ $3 = -\frac{3}{8}(6) + c$ $c = \frac{42}{8}$ $\therefore$ Equation of DC: $y = -\frac{3}{8}x + \frac{42}{8}$	✓ $AB_m = -\frac{3}{8}$ ✓ $DC_m = -\frac{3}{8}$ ✓ $y = -\frac{3}{8}x + c$ ✓ subst.(6 ; 3) ✓ value of c (5)
3.2	D(-2 ; 6)	✓x- coordinate ✓y- coordinate (2)
3.3	$E\left(0;\frac{42}{8}\right)$ Midpoint of DC: $\left(\frac{x_1 + x_2}{2};\frac{y_1 + y_2}{2}\right) = \left(\frac{-2+6}{2};\frac{6+3}{2}\right)$ $=\left(2;\ \frac{9}{2}\right)$ $\therefore E\left(0;\frac{42}{8}\right)$ is not the midpoint of DC	✓ $E\left(0;\frac{42}{8}\right)$ ✓ $\left(\frac{-2+6}{2};\frac{6+3}{2}\right)$ ✓ $\left(2;\ \frac{9}{2}\right)$ ✓ conclusion (4)

3.4	AB $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(4+4)^2 + (1-4)^2}$ AB $= \sqrt{64+9}$ $\therefore$ AB $= \sqrt{73}$	✓ dist. formula ✓ Substitution. ✓ $\sqrt{73}$ (3)
3.5	$AD_m = \frac{6-4}{-2+4} = 1$ $\therefore$ $\tan\theta = 1$ $\therefore$ Inclination $\theta = 45°$	✓ $AD_m = 1$ ✓ $\tan\theta = 1$ ✓ $\theta = 45°$ (3)

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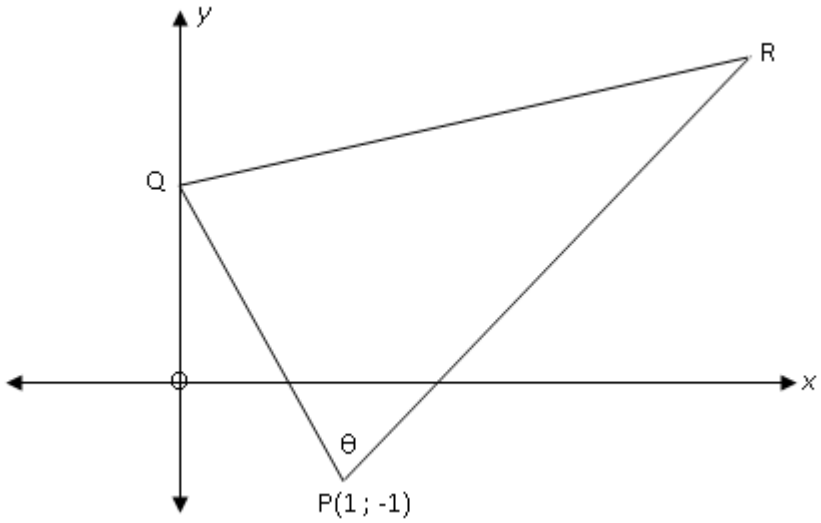
QUESTION 4



4.1	QR: $x - 3y = -6$ $\therefore$ $y = \frac{1}{3}x + 2$ $\therefore$ y coordinate of Q = 2	✓ Equation in st. form ✓ y-coordinate = 2 (2)
4.2	$QR_m = \frac{1}{3}$ $PQ_m = \frac{2-(-1)}{0-1} = -3$ $\therefore$ $QR_m . PQ_m = \frac{1}{3}(-3) = -1$ $\therefore$ the product of the gradients = -1 $\therefore$ PQ $\perp$ QR	✓ $QR_m = \frac{1}{3}$ ✓ $PQ_m = \frac{2-(-1)}{0-1} = -3$ ✓ $QR_m . PQ_m = -1$ (3)

4.3	$PR_m = -1$	✓answer (1)
4.4	$\tan\theta = -3 \quad \therefore \ \theta = 180° - 71{,}57° = 108{,}43°$ $\therefore \ 108{,}43° = \theta + \tan^{-1}(1)$ $\therefore \ 108{,}43° = \theta + 45°$ $\therefore \ \theta = 63{,}43°$	✓ $\tan\theta = -3$ ✓ $108{,}43°$ ✓ $108{,}43° = \theta + \tan^{-1}(1)$ ✓ $45°$ ✓ $\theta = 63{,}43°$ (5)
4.5	$R(x\,;4) \Rightarrow x - 4 - 2 = 0 \ \therefore \ x = 6$ $\therefore S\left(\frac{x_1 + x_2}{2};\frac{y_1 + y_2}{2}\right)$ $= S\left(\frac{0+6}{2};\frac{2+4}{2}\right) = S(3;3)$ $PS_m = \frac{3-(-1)}{3-1} = 2$ $\therefore \ y = 2x + c \ \therefore \ -1 = 2(1) + c \ \therefore \ c = -3$ $\therefore \ y = 2x - 3$	✓ $x = 6$ ✓ $\left(\frac{x_1 + x_2}{2};\frac{y_1 + y_2}{2}\right)$ ✓ $S(3\,;3)$ ✓ $PS_m = 2$ ✓ $y = 2x + c$ ✓ $-1 = 2(1) + c$ ✓ $c = -3$ (7)

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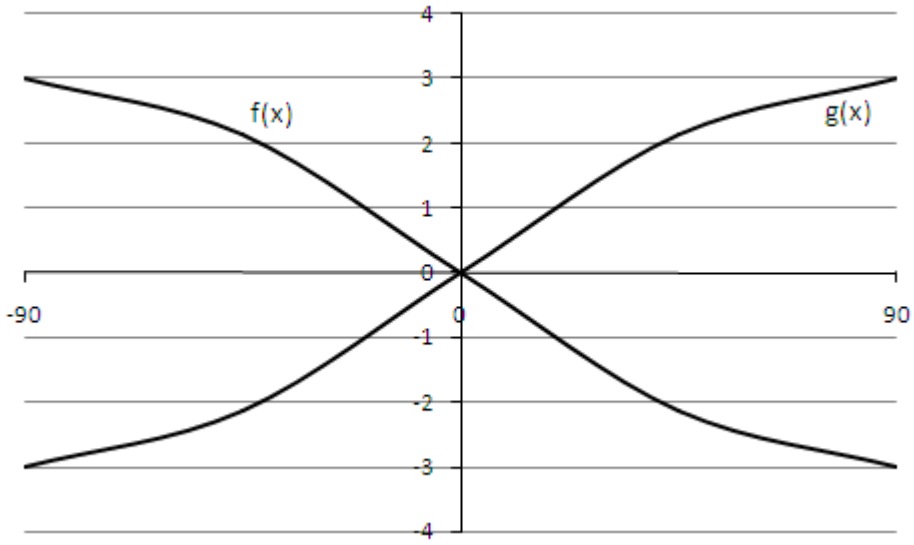
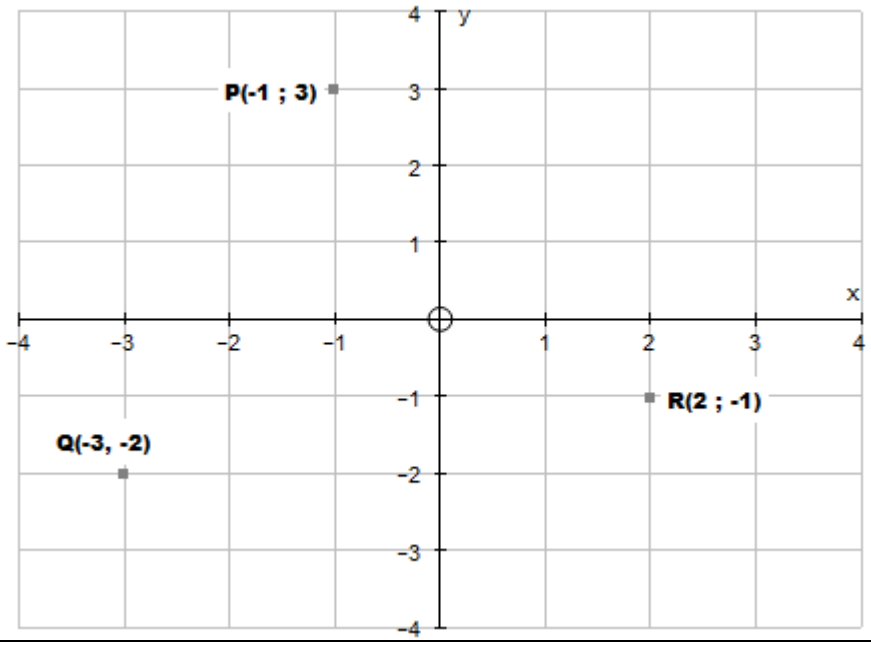
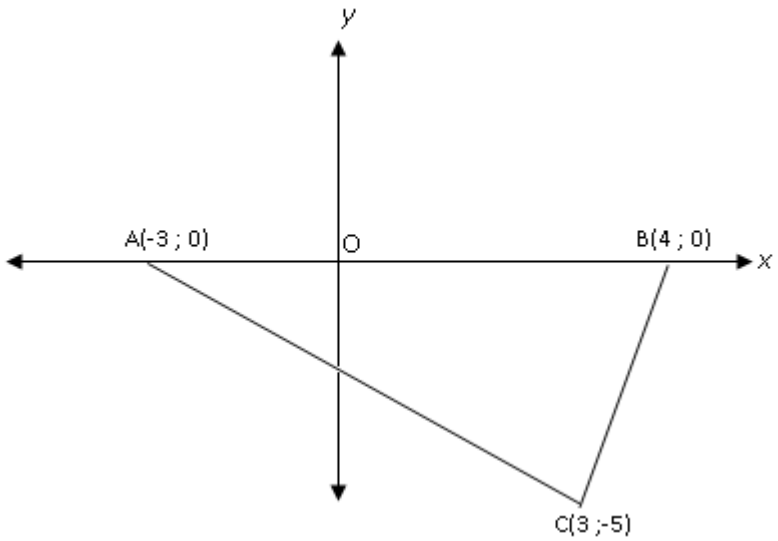
QUESTION 5

5.1		
5.1.1	Maximum at (90˚ ; 3)	✓✓ each coordinate (2)
5.1.2	Turning points at (-90˚ ; -3) ; (90˚ ;3)	✓✓✓✓ coordinates of each point (4)
5.2		

5.2.1	R'(-1 ; 1); P'(-4 ; 5) and Q'(-6 ; 0)	✓✓✓ coordinates of each point (3)
5.2.2	Q'(2;-3)	✓✓ the two coordinates (2)
5.2.3	P"(-3 ; 1)	✓✓ the two coordinates (2)
5.2.4	$(x\ ;\ y) \longrightarrow (-x\ ;\ y)$	✓✓ answer (2)
5.2.5	R"(1 ; 1)	✓✓ answer (2)

5.3



5.3.1	Area of ΔABC: $= \frac{1}{2}bh \Rightarrow$ Area $= \frac{1}{2}AB.h = \frac{1}{2}7(5)$ $= 17{,}5$ sq. units	✓ $\frac{1}{2}7(5)$ ✓ answer (2)
5.3.2	Factor of 4	✓✓ answer (2)
5.3.3	$\Delta ABC : \Delta A'B'C' = 1 : 2$	✓✓ answer (2)
5.3.4	A'B' = 14 units	✓✓ answer (2)

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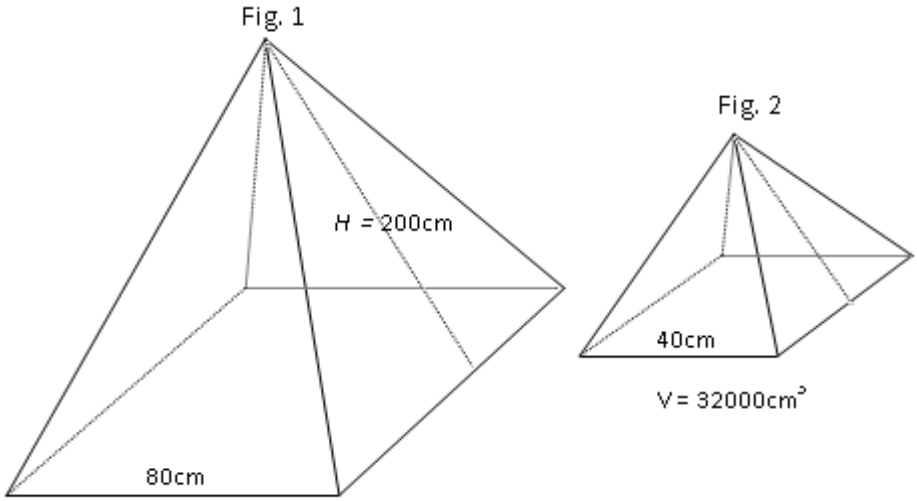
QUESTION 6



6.1	Perp. Height of Fig. 1: $h^2 = H^2 - 40^2$ $h^2 = 200^2 - 40^2$ $h^2 = 40000 - 1600$ $h^2 = 38400$ $\therefore$ $h \approx 195{,}96$ cm $\therefore$ Vol. of pyramid: $V = \frac{1}{3}$ area of base. Height $V = \frac{1}{3}(80)(80)(195{,}96)\,cm^3$ $V = 418048\ cm^3$	✓ $h^2 = 200^2 - 40^2$ ✓ $h \approx 195{,}96$ cm ✓ method/ formula ✓ substitution ✓ answer (5)
6.2	$V = \frac{1}{3}$ area of base. Height $\therefore$ $32\,000 = \frac{1}{3}(40)(40)h\ \ cm^3$ $\therefore$ $h = 60$ cm Slant height: $H^2 = 60^2 + 20^2$ $\therefore$ H = 63,25 cm $\therefore$ area of one side: $A = \frac{1}{2}b.h = \frac{1}{2}40(63{,}25) = 1265\ cm^2$ $\therefore$ surface area $= 1265 \times 4 = 5060\ cm^2$	✓ method and subst. for V ✓ h = 60 cm ✓ H = 63,25 cm ✓ Area formula and subst. ✓ area of 1 side ✓ area for 4 sides (6)

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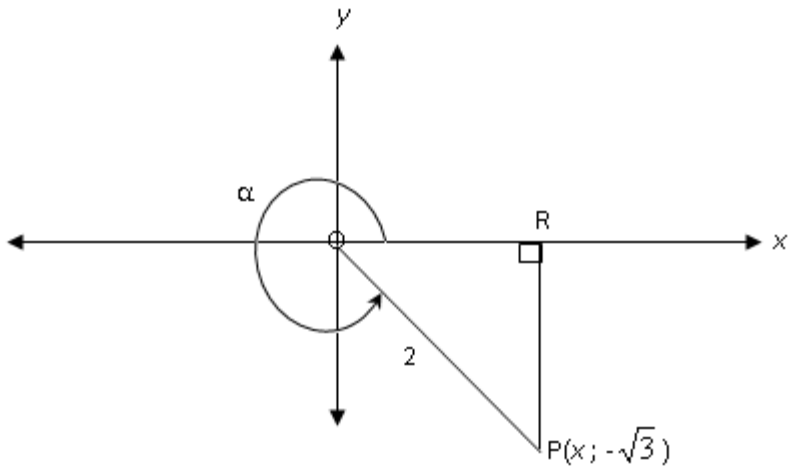
QUESTION 7

7.1



7.1.1	$x = 1$	✓ answer (1)
7.1.2	$\sin(360^\circ - \alpha) = -\sin\alpha = -(-\frac{\sqrt{3}}{2}) = \frac{\sqrt{3}}{2}$	✓ $-\sin\alpha$ ✓ answer (2)
7.2	$\cos160^\circ = -\cos20^\circ = \frac{1}{p}$ $\sin250^\circ = -\sin70^\circ = -\cos20^\circ = \frac{1}{p}$	✓ $-\cos20^\circ$ ✓ $-\sin70^\circ$ ✓ $-\cos20^\circ$ ✓ $\frac{1}{p}$ (4)

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QUESTION 8

8.1	$\frac{1}{\cos^2 x} + \frac{1}{\sin^2 x} = \frac{\sin^2 x + \cos^2 x}{\cos^2 x.\sin^2 x}$ $= \frac{(\sin^2 x + \cos^2 x) = 1}{\cos^2 x.\sin^2 x}$ $= \frac{1}{\cos^2 x.\sin^2 x}$	✓ denominator ✓ simplification of fraction ✓ identity (3)
8.2	$\sqrt{\frac{\sin(-390°)}{\cos 240°} + \tan(180° + \theta).\cos(180° + \theta).\cos(90° - \theta)}$ $= \sqrt{\frac{-\sin 30°}{-\cos 60°} + \tan\theta.-\cos\theta.\sin\theta}$ $= \sqrt{\frac{-\sin 30°}{-\sin 30°} + \tan\theta.-\cos\theta.\sin\theta}$ $= \sqrt{1 - \frac{\sin\theta}{\cos\theta}.-\cos\theta.\sin\theta}$ $= \sqrt{1 - \sin^2\theta}$ $= \sqrt{\cos^2\theta}$ $= \cos\theta$	✓-sin30° ✓-cos60° ✓ tanθ ✓-cosθ ✓ sinθ ✓sin30° ✓ $\frac{\sin\theta}{\cos\theta}$ ✓simplification ✓ cosθ (9)

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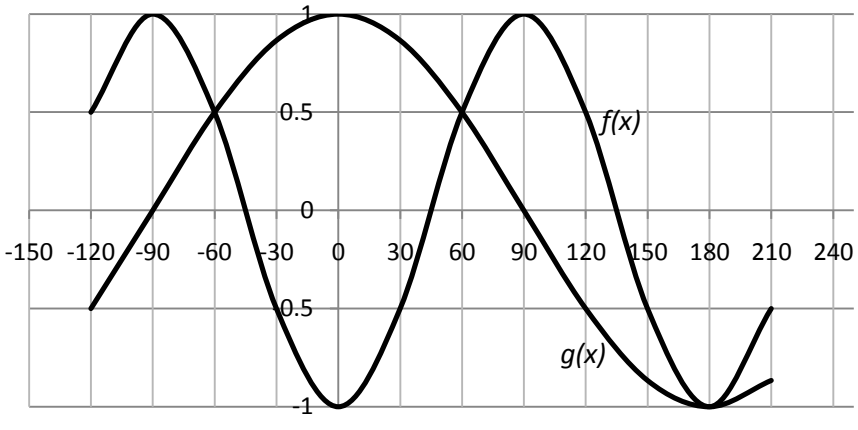
QUESTION 9



✓✓ both *x*-intercepts

✓✓ both *y*-intercepts

✓✓ both turning points (6)

9.2.1	$g(x) = 1 - \frac{1}{2}$ $\therefore\ g(x) = \frac{1}{2}$ $\therefore\ x = -60^\circ$ or 60°	✓✓ each value (2)
9.2.2	$x = 180^\circ$	✓✓ answer (2)
9.2.3	$-60^\circ < x < 60^\circ$ **or** $x \in (-60^\circ ; 60^\circ)$	✓✓ both endpoints ✓notation (3)

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QUESTION 10

10.1	$\cos 2\theta = 0,25$			✓ $\cos 2\theta = 0,25$ ✓ Ref. angle and quad. ✓✓✓ for each answer (5)
	$2\theta = 75, 5224...^\circ$ **$\theta = 37,76^\circ$**	or $2\theta = 360^\circ - 75, 5224...^\circ$ **$\theta = 142,24^\circ$**	or $2\theta = -75, 5224...^\circ$ **$\theta = -37,76^\circ$**	
10.2	$3 \tan 2x = 3,2$ $\therefore \tan 2x = 1, 06666\ldots$ Ref. angle = $46,85^o$			✓ simplification ✓ ref. angle ✓angle in 3rd quad.
	$\therefore 2x = 46,85^\circ + 180^\circ k$ $x = 23,43^\circ + 90^\circ k$ $k \in Z$	or $2x = 180^\circ + 46,85^\circ + 180^\circ k$ $x = 113,43^o + 90^\circ k;\ k \in Z$		✓ value of x ✓ value of x (5)

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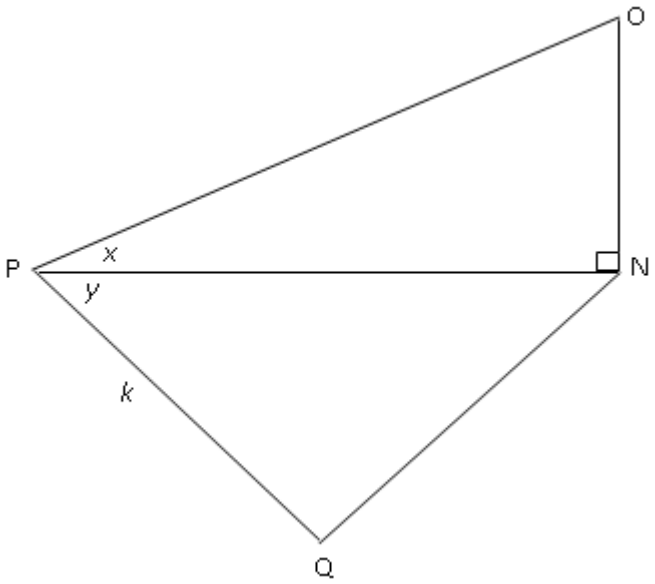
QUESTION 11



11.1	Area of $\Delta NPQ = \frac{1}{2}PN.PQ\sin P$ $\therefore\ h = \frac{1}{2}PN.k\sin y \quad \therefore\ PN = \frac{2h}{k\sin y}$	✓ subst. in sine form. ✓ simplification (2)
11.2	$\frac{ON}{PN} = \tan x \quad \therefore\ ON = PN.\tan x$ $ON = \frac{2h\tan x}{k\sin y}$	✓ tan ratio ✓ simplification ✓ $\frac{2h\tan x}{k\sin y}$ (3)
11.3	$PN = \frac{ON}{\tan x}$ $\therefore\ \text{Area} = \frac{1}{2}186(106,02)\sin 31,7°$ $PN = \frac{30}{\tan 15,85°} = 5181,08\ m^2$ PN = 106,02 m	✓ $PN = \frac{ON}{\tan x}$ ✓ PN = 106,02 ✓ Subst. in area form. ✓ answer (4)

[9]

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