basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P2

FEBRUARY/MARCH 2012

MEMORANDUM

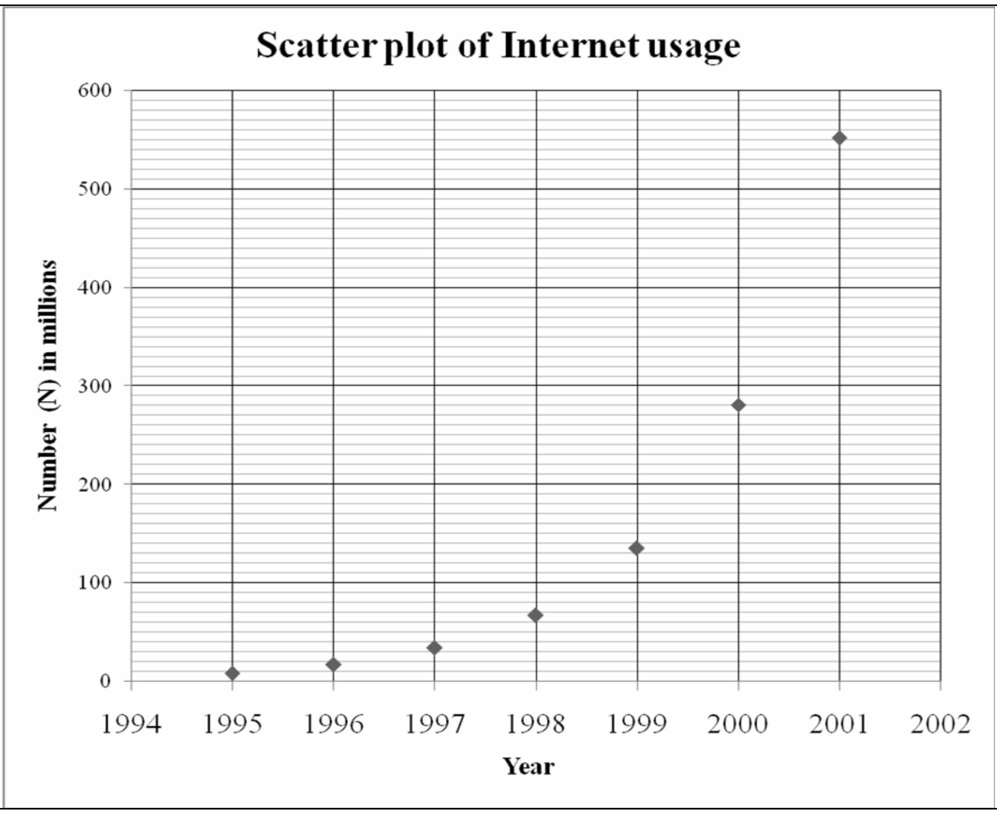
MARKS: 150

This memorandum consists of 18 pages.

QUESTION 1

1.1	Mean $\frac{\sum_{1}^{n} x_1}{n} = \frac{102100}{9}$ $= R11\ 344,\ 44$	✓ 102100 ✓ answer (2)
1.2	Standard deviation $\sqrt{\frac{\sum_{1}^{n}(x_1 - \bar{x})^2}{n}} = \quad R4\ 460,97$	✓✓ answer (2)
1.3	Value of one standard deviation above mean = R11 344,44 + R4 460,97 = R15 805,41 Only one person earned a commission of more than R 15 805,41. Therefore only 1 person received a rating of good.	✓ adding mean and std. dev. ✓ deduction (2) **[6]**

QUESTION 2

2.1		✓ at least four points correct ✓ all points correct (2)
2.2	Exponential (The increase in growth is showing a virtual doubling for each year).	✓exponential (1)

2.3

YEAR	1995	1996	1997	1998	1999	2000	2001
N (Number in millions)	8	17	34	67	135	281	552
Log N (correct to 1 decimal place)	6,9	7,2	7,5	7,8	8,1	8,4	8,7

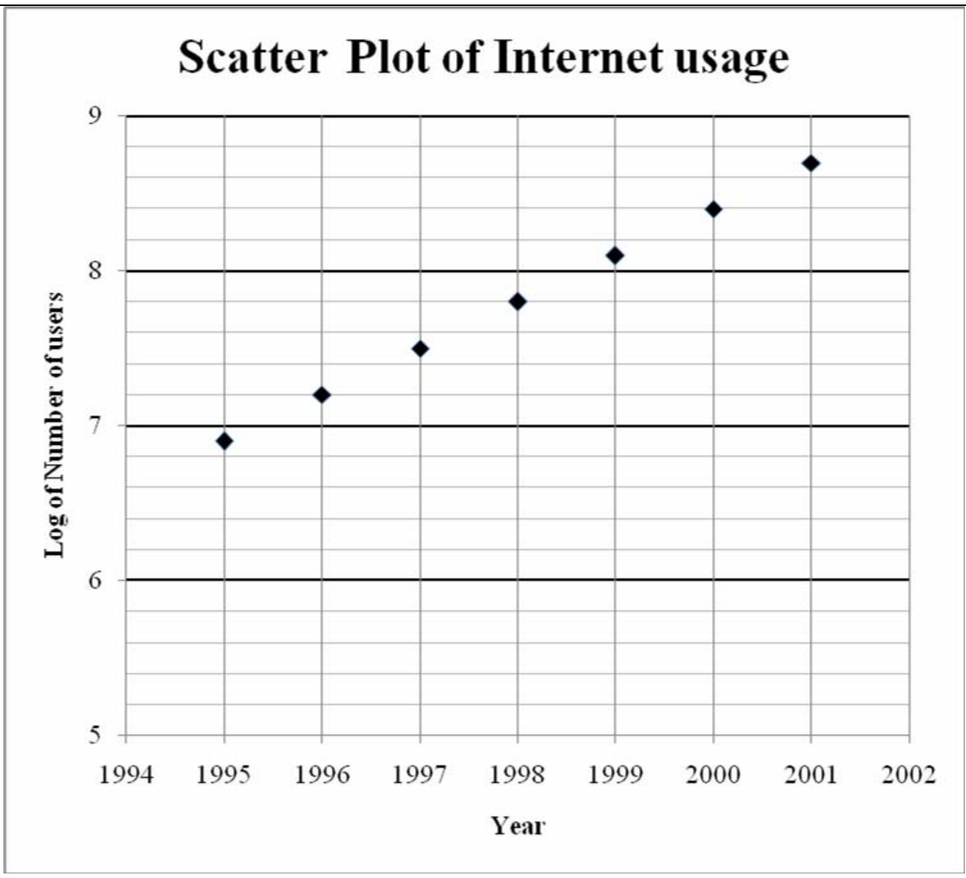
✓ at least four values correct
✓ all values correct
(2)

OR (if only log of values in table taken in account)

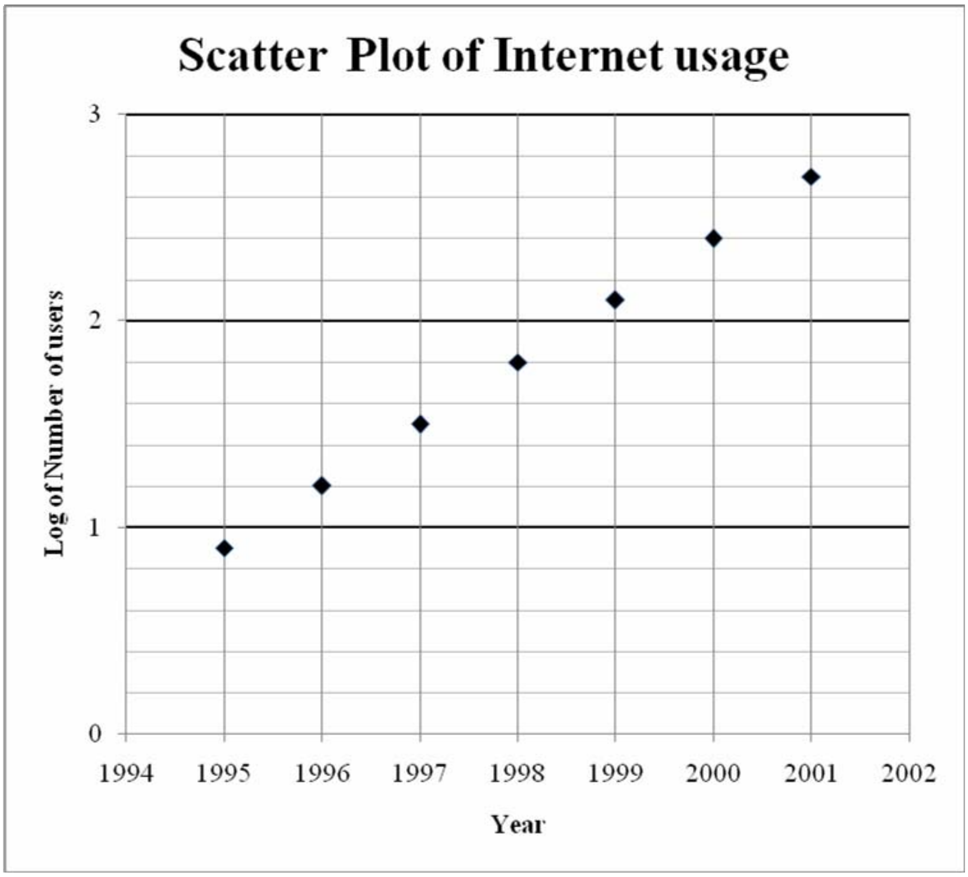
YEAR	1995	1996	1997	1998	1999	2000	2001
N (Number in millions)	8	17	34	67	135	281	552
Log N (correct to 1 decimal place)	0,9	1,2	1,5	1,8	2,1	2,4	2,7

✓ at least four values correct
✓ all values correct
(2)

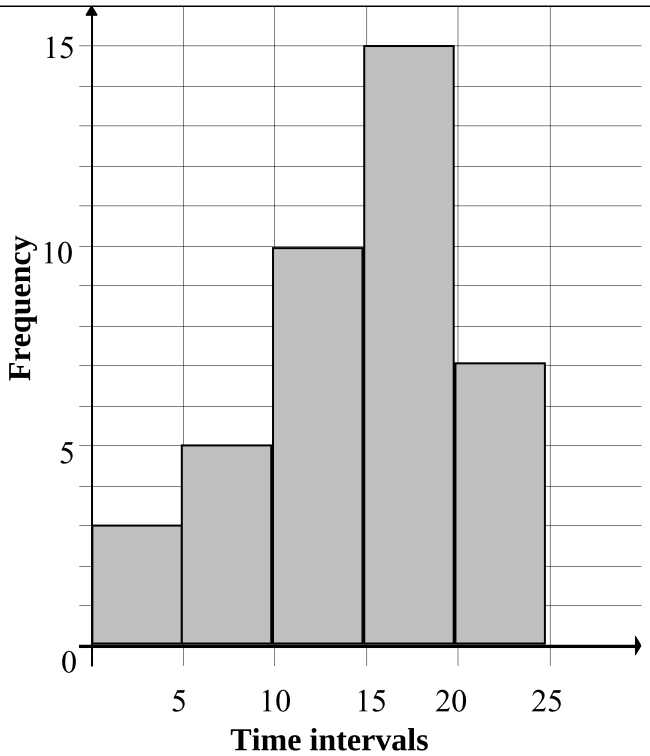
2.4



✓ at least 4 points correctly plotted
✓ all points correct
(2)

	OR (if only log of values in table taken in account) 	✓ at least 4 points correctly plotted ✓ all points correct (2)
2.5	The graph representing log N is a straight line. That is, $\log N = mx + c$ $N = 10^{mx+c}$ Therefore exponential graph.	✓linear ✓ reason (2) **[9]**

QUESTION 3

3.1	40	✓ 40 (1)
3.2	<table><tr><th>Time, t, in minutes</th><th>Frequency</th></tr><tr><td>$0 \leq t < 5$</td><td>3</td></tr><tr><td>$5 \leq t < 10$</td><td>5</td></tr><tr><td>$10 \leq t < 15$</td><td>10</td></tr><tr><td>$15 \leq t < 20$</td><td>15</td></tr><tr><td>$20 \leq t < 25$</td><td>7</td></tr></table>	✓ for intervals in table ✓ for first three correct frequencies ✓ for last two correct frequencies (3)
3.3		✓first three bars correct ✓last two bars correct ✓no gaps between bars (3) **[7]**

QUESTION 4

$a = 7$	$b = 15$	$c = 17$	$d = 23$	$e = 34$	$f = 37$	$g = 42$	✓ each correct answer (7)

OR

$g = 42$; $a = 7$; $d = 23$; $f = 37$; $b = 15$

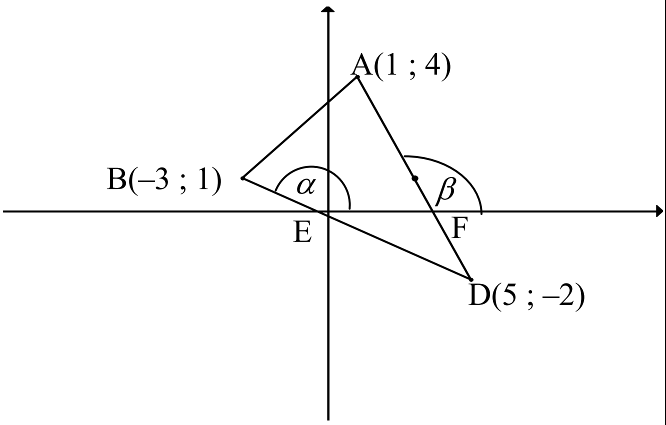
$$\frac{42 + 7 + 23 + 37 + 15 + 3c}{7} = 25$$

$$3c = 51$$
$$c = 17$$
$$e = 34$$

✓ g
✓ a
✓ d
✓ f
✓ b
✓ c
✓ e (7)
[7]

QUESTION 5

5.1	$m_{AD} = \dfrac{y_2 - y_1}{x_2 - x_1}$ $= \dfrac{-2-4}{5-1}$ $= -\dfrac{6}{4} = -\dfrac{3}{2}$	✓ for substitution ✓ for answer (2)
5.2	AD $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(5-1)^2 + (-2-4)^2}$ $= \sqrt{16+36}$ $= \sqrt{52}$	✓ for substitution ✓ $\sqrt{52}$ (2)
5.3	$M = \left(\dfrac{x_1 + x_2}{2} ; \dfrac{y_1 + y_2}{2}\right)$ $M = \left(\dfrac{1+5}{2} ; \dfrac{4-2}{2}\right)$ $M = (3 ; 1)$	✓ x-value ✓ y-value (2)
5.4	$m_{BC} = m_{AD}$ Lines are parallel $= -\dfrac{3}{2}$ $y - y_1 = m(x - x_1)$ $y - 1 = -\dfrac{3}{2}(x+3)$ $2y - 2 = -3x - 9$ $3x + 2y + 7 = 0$ **OR** $y = -\dfrac{3}{2}x + c$ $1 = -\dfrac{3}{2}(-3) + c$ $c = -\dfrac{7}{2}$ $y = -\dfrac{3}{2}x - \dfrac{7}{2}$ $3x + 2y + 7 = 0$	✓ value m_{BC} ✓ subst (–3 ; 1) ✓ equation (3) ✓ value m_{BC} ✓ subst (–3 ; 1) ✓ equation (3)

5.5.1	$m_{AD} = -\frac{3}{2}$ $\tan\beta = -\frac{3}{2}$ $\beta = 180° - 56{,}31°$ $\beta = 123{,}69$ 	✓ $\tan\beta = m_{AD}$ ✓ 123,69° (2)
5.5.2	$m_{BD} = \frac{-2-1}{5-(-3)} = \frac{-3}{8}$ $\tan\alpha = -\frac{3}{8}$ $\alpha = 180° - 20{,}56°$ $\alpha = 159{,}44°$ $F\hat{E}D = 180° - 159{,}44° = 20{,}56°$ $E\hat{F}D = 123{,}69°$ $F\hat{D}E = 180° - (20{,}56° + 123{,}69°) = 35{,}75°$	✓ $m_{BD} = \frac{-3}{8}$ ✓159,44° ✓20,56° ✓123,69° ✓35,75° (5)
5.6	Co-ordinates of centre M (3 ; 1) Radius of circle: $\frac{1}{2}$ of AD = $\frac{1}{2}$ $(2\sqrt{13}) = \sqrt{13} = \frac{1}{2}\sqrt{52}$ Equation of the circle is: $(x-3)^2 + (y-1)^2 = 13$ **OR** $r^2 = (3-1)^2 + (1-4)^2 = 13$ Equation of the circle is: $(x-3)^2 + (y-1)^2 = 13$	✓ value of radius ✓ substitution into equation of circle centre form (2) ✓ value of r^2 ✓ substitution into equation of circle centre form (2)
5.7	M(3 ; 1) B(– 3 ; 1) $MB = \sqrt{(3+3)^2 + (1-1)^2}$ MB = 6 Point B lies outside the circle because MB > radius **OR** M(3 ; 1) B(– 3 ; 1) MB = 3 + 3 = 6 Radius of the circle = $\sqrt{13} < 6$ Point B lies outside the circle because MB > radius	✓substitution ✓outside (2) ✓substitution ✓outside (2) **[20]**

QUESTION 6

6.1	Coordinates of centre M (–2 ; 1) $(1+2)^2+(-2-1)^2=18=r^2$ Radius = $\sqrt{18}$ or $3\sqrt{2}$	✓✓ coordinates of centre ✓ calculation ✓ value (4)
6.2	$m_{MS}=\frac{-3}{3}=-1$ $m_{MS} x m_{RS}=-1$ OR tangent ⊥ radius $m_{RS}=1$ $y-y_1=m(x-x_1)$ $y+2=1(x-1)$ $y=x-3$ **OR** $m_{MS}=\frac{-3}{3}=-1$ $m_{MS} x m_{RS}=-1$ $m_{RS}=1$ $y=x+c$ $-2=1+c$ $c=-3$ $y=x-3$	✓ gradient MS ✓ gradient RS ✓ subst (1 ; –2) ✓ equation (4) ✓ gradient MS ✓ gradient RS ✓ subst (1 ; –2) ✓ equation (4)
6.3	$\frac{MS}{MP}=\frac{1}{3}$ $\therefore MP=3MS$ $MP^2=9MS^2$ $(a+2)^2+(b-1)^2=9(3^2+3^2)=162$ (1) $MS \perp SR \text{ and } PS \perp SR \quad \therefore m_{PS}=m_{MS}$ $\frac{b+2}{a-1}=\frac{3}{-3}=-1$ $b+2=-a+1$ $b=-a-1$ (2) Subst (2) into(1)	✓ MP = 3MS ✓ equation ✓ equal gradients ✓ gradient ✓ $b=-a-1$

	$(a+2)^2+(-a-1-1)^2=162$ $(a+2)^2+(a+2)^2=162$ $2(a+2)^2=162$ $(a+2)^2=81$ $a+2=9 \text{ or } -9$ $a=7 \text{ or } -11$ $b=-a-1=-8$ $P(7\,;-8)$	✓substitution ✓ $a = 7$ ✓ $b = -8$ (8)
	OR $\frac{MS}{MP}=\frac{1}{3}$ $\therefore MP=3MS$ $MP^2=9MS^2$ $(a+2)^2+(b-1)^2=9(3^2+3^2)=162$ (1) $MS \perp SR \text{ and } PS \perp SR \quad \therefore m_{PS}=m_{MS}$ $\frac{b+2}{a-1}=\frac{3}{-3}=-1$ $b+2=-a+1$ $b=-a-1$ (2) Subst (2) into(1) $a^2+4a+4+a^2+4a+4=162$ $2a^2+8a-154=0$ $a^2+4a-77=0$ $(a+11)(a-7)=0$ $a=7 \text{ or } -11$ But $a>0$ $\therefore a=7$ $b=-a-1=-8$ $P(7\,;-8)$	✓ MP = 3MS ✓ equation ✓ equal gradients ✓ gradient ✓ $b = -a - 1$ ✓substitution ✓ $a = 7$ ✓ $b = -8$ (8)
	OR	

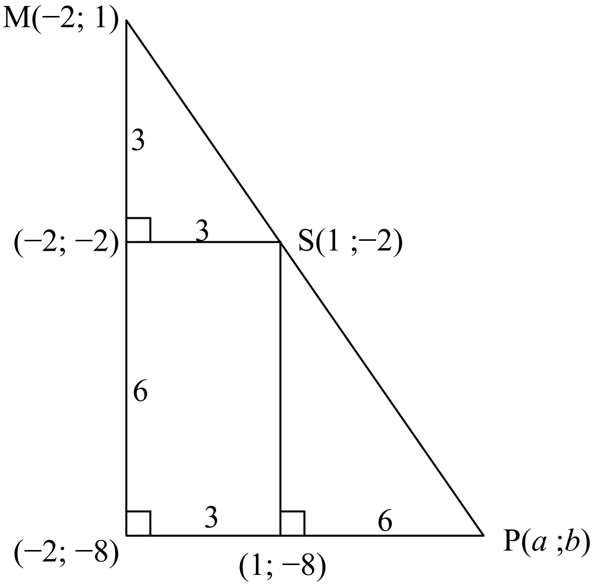
P(a ; b)
MSP is a straight line (MS ⊥ SR)
$m_{PM} = -1$
$\frac{b-1}{a+2} = -1$
$b - 1 = -a - 2$
$b = -a - 1 ....(1)$
$PS = 2MS = 2\sqrt{9+9} = 2\sqrt{18}$
$PS^2 = 4(18) = 72$
$(a-1)^2 + (b+2)^2 = 72 ....(2)$
$(a-1)^2 + (-a-1+2)^2 = 72$
$2a^2 - 4a - 70 = 0$
$a^2 - 2a - 35 = 0$
$(a-7)(a+5) = 0$
$a = 7 \; or \; a \neq -5$
$b = -7 - 1 = -8$
$P(7 ; -8)$

OR

$2(a-1)^2 = 72$
$(a-1)^2 = 36$
$a - 1 = 6$ or -6
$a = 7$ or -5
$a = 7$
$b = -8$
$P(7 ; -8)$

✓ MSP a straight line
✓ $m_{PM} = -1$
✓ $\frac{b-1}{a+2}$
✓ equation 1
✓ equation 2
✓ substitution of equation 1 into equation 2
✓✓ coordinates
(8)

OR

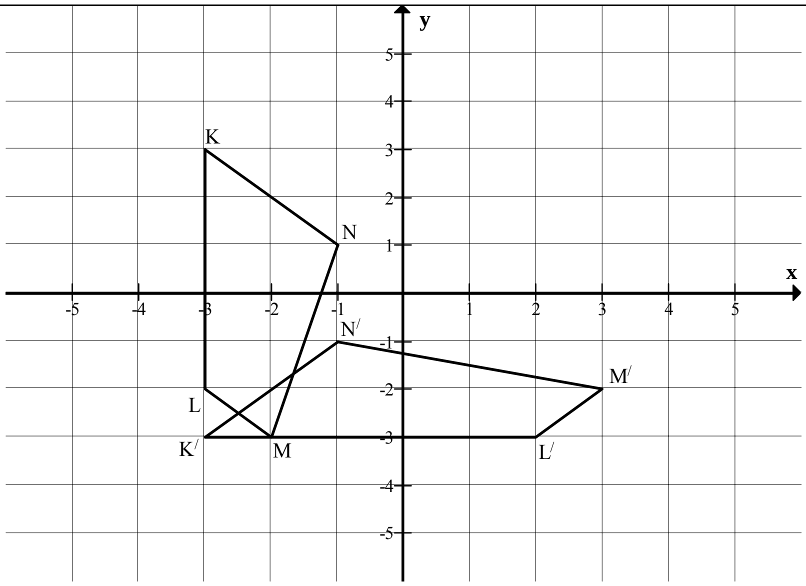


✓✓ diagram
✓✓ (−2; −8)
✓ (−2; −2)
✓ (1; −8)
✓✓ P(7 ; −8)
(8)

✓✓ division of line segment into

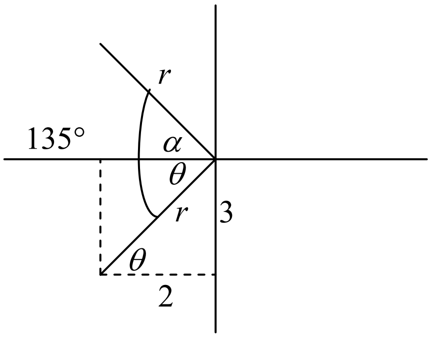
	P(a ; b) $\dfrac{x_S - x_M}{x_P - x_M} = \dfrac{y_S - y_M}{y_P - y_M} = \dfrac{1}{3}$ $\dfrac{-3}{b-1} = \dfrac{3}{a+2} = \dfrac{1}{3}$ $-9 = b - 1$ $b = -8$ $9 = a + 2$ $a = 7$ $P(7\,;-8)$	given ratio ✓✓substitution ✓ equation ✓equation ✓coordinates (8) **[16]**

QUESTION 7

7.1		For correct coordinates and label of each image: ✓ K' ✓ L' ✓ M' ✓ N' (4)
7.2.1	Transformation is not rigid, because the area is not preserved under enlargement.	✓ not rigid ✓ size not preserved (2)
7.2.2	$N^{//}(-2\,;-2)$	✓✓ coordinates of $N^{//}$ (2)
7.3	$(x\,;y) \rightarrow (-y\,;x) \rightarrow (-2y\,;2x)$	✓ $-y$ ✓ x ✓ $-2y$ ✓ $2x$ (4)
7.4	Area of KLMN : area of $K^{//}L^{//}M^{//}N^{//}$ = 1 : 4	✓✓ answer (2)
7.5	If the point that is furthest away from the origin is sent into the circle, the whole quadrilateral is sent into the circle. K is furthest away. $\text{KO} = \sqrt{3^2 + 3^2} = \sqrt{18}$ $p.\text{KO} = 1\,,\; p = \dfrac{1}{\sqrt{18}}$	✓ K – furthest ✓ $\text{KO} = \sqrt{18}$ ✓ answer (3) **[17]**

QUESTION 8

8.	$x_Q = x\cos\theta + y\sin\theta$ $x_Q = -2\cos135° + (-3)\sin135°$ $x_Q = \frac{2}{\sqrt{2}} - \frac{3}{\sqrt{2}} = \frac{-1}{\sqrt{2}}$ or $\frac{-\sqrt{2}}{2}$ or $-0{,}71$ $y_Q = y\cos\theta - x\sin\theta$ $y_Q = -3\cos135° - (-2)\sin135°$ $y_Q = \frac{3}{\sqrt{2}} + \frac{2}{\sqrt{2}} = \frac{5}{\sqrt{2}} = \frac{5\sqrt{2}}{2} = 3{,}54$ $Q\left(\frac{-1}{\sqrt{2}};\frac{5}{\sqrt{2}}\right)$	✓ subst –2 and –3 into correct formula for x_Q ✓ using 135° ✓ x coordinate (in any format) ✓ subst –2 and –3 into correct formula for y_Q ✓ for y coordinate (in any format) (5)
	OR	
	$x_Q = x\cos\theta - y\sin\theta$ $x_Q = -2\cos(-135°) - (-3)\sin(-135°)$ $x_Q = \frac{2}{\sqrt{2}} - \frac{3}{\sqrt{2}} = \frac{-1}{\sqrt{2}}$ or $\frac{-\sqrt{2}}{2}$ or $-0{,}71$ $y_Q = y\cos\theta + x\sin\theta$ $y_Q = -3\cos(-135°) + (-2)\sin(-135°)$ $y_Q = \frac{3}{\sqrt{2}} + \frac{2}{\sqrt{2}} = \frac{5}{\sqrt{2}} = \frac{5\sqrt{2}}{2} = 3{,}54$ $Q\left(\frac{-1}{\sqrt{2}};\frac{5}{\sqrt{2}}\right)$	✓ subst –2 and –3 into correct formula for x_Q ✓ using –135° ✓ x-coordinate (in any format) ✓ subst –2 and –3 into correct formula for y_Q ✓ for y-coordinate (in any format) (5)
	OR	
	$x' = x\cos\theta - y\sin\theta$ $-2 = x\cos135° - y\sin135°$ $-2 = \frac{-x}{\sqrt{2}} - \frac{y}{\sqrt{2}}$ $-2\sqrt{2} = -x - y$ (1) $y' = y\cos\theta + x\sin\theta$ $-3 = y\cos135° + x\sin135°$ $-3 = \frac{-y}{\sqrt{2}} + \frac{x}{\sqrt{2}}$ $-3\sqrt{2} = x - y$ (2) Solving (1) and (2) simultaneously: $-5\sqrt{2} = -2y$ $y = \frac{5}{\sqrt{2}}$ and $x = \frac{-1}{\sqrt{2}}$	✓ subst –2 and 135° into correct formula for x' ✓ simplification ✓ subst –2 and 135° into correct formula for y' ✓ y-coordinate ✓ x-coordinate (5)

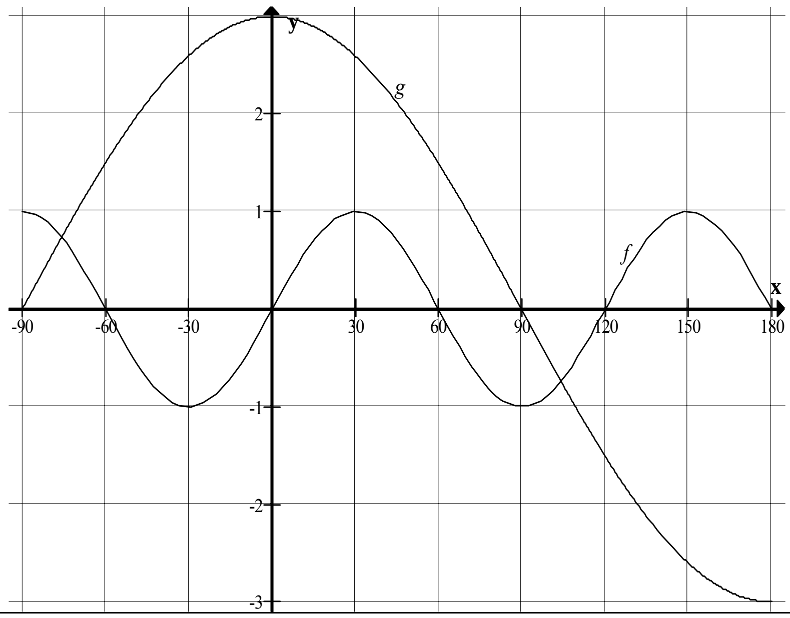
	OR Using first principles: $Q = (-r\cos\alpha ; r\sin\alpha)$  $Q^{/} = (-2\ ;\ -3)$ $\tan\theta = \frac{3}{2}$ $r = \sqrt{3^2 + 2^2} = \sqrt{13}$ $\theta = 56{,}31°$ $\therefore \alpha = 135° - 56{,}31° = 78{,}69°$ $Q = (-r\cos\alpha ; r\sin\alpha)$ $= (-0{,}71 ; 3{,}54)$	✓ $\tan\theta = \frac{3}{2}$ ✓ $r = \sqrt{13}$ ✓ $\theta = 56{,}31°$ ✓ $Q = (-r\cos\alpha ; r\sin\alpha)$ ✓ answer (5) **[5]**

QUESTION 9

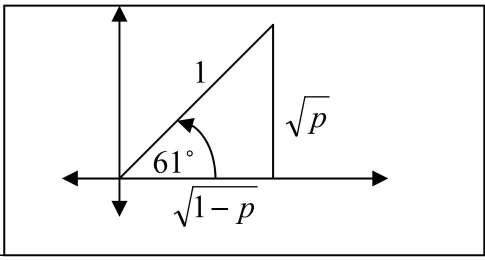
9.1.1	$r = 13$ $\cos\alpha = \frac{12}{13}$	✓ 13 ✓ $\frac{12}{13}$ (2)
9.1.2	$\hat{TOR} = 180° - (90° + \alpha)$ $= 90° - \alpha$	✓ $180° - (90° + \alpha)$ ✓ $90° - \alpha$ (2)

9.1.3	$\cos \hat{TOR} = \frac{TR}{OT}$ $\cos(90° - \alpha) = \frac{7,5}{OT}$ $OT = \frac{7,5}{\cos(90° - \alpha)}$ $OT = \frac{7,5}{\sin\alpha}$ $OT = \frac{7,5}{\frac{5}{13}}$ $OT = 19,5$ **OR** $\sin(R\hat{T}O) = \frac{7,5}{OT}$ $\therefore OT = \frac{7,5}{\sin\alpha}$ $OT = \frac{7,5}{\frac{5}{13}}$ $OT = 19,5$	✓ $\cos(90° - \alpha) = \frac{7,5}{OQ}$ ✓ $\frac{7,5}{\sin\alpha}$ ✓ $\frac{5}{13}$ ✓ 19,5 (4) ✓ $\sin(R\hat{Q}O) = \frac{7,5}{OQ}$ ✓ $\frac{7,5}{\sin\alpha}$ ✓ $\frac{5}{13}$ ✓ 19,5 (4)
9.2	$LHS = \frac{\cos x.\cos x(-\tan x)}{-\cos x}$ $= \cos x.\frac{\sin x}{\cos x}$ $= \sin x$ $= RHS$	✓ $\cos x$ ✓ $-\tan x$ ✓ $\frac{\sin x}{\cos x}$ ✓ answer (4) **[12]**

QUESTION 10

10.1	Period = 120º	✓ 120° (1)
10.2	sin 3x = -1 $x = -30°$ or $x = 90°$	✓ – 30° ✓ 90° (2)
10.3	Maximum value of $f(x)$ is 1 $\therefore$ Maximum value of $h(x)$ is 0	✓ max of $f(x)$ ✓ answer (2)
10.4		✓ $-90°$; $90°$ ✓ $(0°;3)$ ✓ $(180°;-3)$ (3)
10.5	$\frac{\sin 3x}{3} - \cos x = 0$ $\sin 3x - 3\cos x = 0$ $\therefore \sin 3x = 3\cos x$ There are 2 solutions where graphs f and g are equal	✓ sin 3x = 3 cos x ✓ answer (2)
10.6	$f(x).g(x) < 0$ $x \in$ (–60º ; 0º) or (60º ; 90º) or (120º ; 180º) **OR** –60°< x < 0° or 60°< x < 90° or 120°< x < 180°	✓✓✓ for each interval ✓ correct brackets or correct symbols (4) **[14]**

QUESTION 11

11.1.1	$\sin 61° = \sqrt{p}$ $\sin 241° = \sin(180° + 61°)$ $= -\sin 61°$ $= -\sqrt{p}$  	✓ $-\sin 61°$ ✓answer (2)
11.1.2	$\cos 61° = \sqrt{1-\sin^2 61°}$ $= \sqrt{1-p}$	✓ identity ✓ answer (2)
11.1.3	$\cos 122° = \cos 2(61°)$ $= 2\cos^2 61° - 1$ $= 2\left(\sqrt{1-p}\right)^2 - 1$ $= 2(1-p) - 1$ $= 2 - 2p - 1$ $= 1 - 2p$	✓ double angle ✓ expansion ✓ answer (3)
11.1.4	$\cos 73° \cos 15° + \sin 73°.\sin 15°$ $= \cos(73° - 15°)$ $= \cos 58° = (\cos 180° - 122°)$ $= -(\cos 122°)$ $= -(1-2p)$ $= 2p - 1$	✓ $\cos(73°-15°)$ ✓ $-(\cos 122°)$ ✓ answer (3)
11.2.1	$\text{LHS} = \dfrac{(\cos x + \sin x)^2 - (\cos x - \sin x)^2}{(\cos x - \sin x)(\cos x + \sin x)}$ $= \dfrac{\cos^2 x + 2\cos x \sin x + \sin^2 x - (\cos^2 x - 2\sin x \cos x + \sin^2 x)}{(\cos x - \sin x)(\cos x + \sin x)}$ $= \dfrac{4\cos x \sin x}{\cos^2 x - \sin^2 x}$ $= \dfrac{2\sin 2x}{\cos 2x}$ $= 2\tan x$ $= \text{RHS}$	✓ $\dfrac{(\cos x + \sin x)^2 - (\cos x - \sin x)^2}{(\cos x - \sin x)(\cos x + \sin x)}$ ✓numerator ✓ $4\cos x \sin x$ ✓ $\cos^2 x - \sin^2 x$ ✓ $2\sin 2x$ ✓ $\cos 2x$ (6)
11.2.2	$\cos x = \sin x$ or $\cos x = -\sin x$ $x = 45°$ $x = 135°$	✓✓ for answer (2)
11.3.1	$\sin x = \cos 2x - 1$ $\sin x = 1 - 2\sin^2 x - 1$ $\sin x = -2\sin^2 x$ $2\sin^2 x + \sin x = 0$	✓ $1 - 2\sin^2 x$ (1)

11.3.2	$\sin x = \cos 2x - 1$ $2\sin^2 x + \sin x = 0$ $\sin x(2\sin x + 1) = 0$ $\sin x = 0$ or $\sin x = -\frac{1}{2}$ $\therefore x = 0° + 180° k;\ k \in Z$ or $x = \{210° \text{ or } 330°\} + 360°k;\ k \in Z$ **OR** $x = n.180°$ $x = n.360° - 30°$ $x = (2n+1).180° + 30°, n \in Z$	✓ $\sin x(2\sin x + 1) = 0$ ✓ $\sin x = 0$ or $\sin x = -\frac{1}{2}$ ✓ $0° + 180° k$ ✓ 210° ✓ 330° ✓ $+ 360°k;\ k \in Z$ (6)

11.4	$\tan 1° \times \tan 2° \times \tan 3° \times \tan 4° \times \ldots\ldots \times \tan 87° \times \tan 88° \times \tan 89°$ $= \left(\frac{\sin 1°}{\cos 1°}\right)\left(\frac{\sin 2°}{\cos 2°}\right)\ldots\ldots\left(\frac{\sin 45°}{\cos 45°}\right)\ldots\ldots\left(\frac{\sin 88°}{\cos 88°}\right)\left(\frac{\sin 89°}{\cos 89°}\right)$ $= \left(\frac{\sin 1°}{\cos 1°}\right)\left(\frac{\sin 2°}{\cos 2°}\right)\ldots\ldots\left(\frac{\sin 45°}{\cos 45°}\right)\ldots\ldots\left(\frac{\sin(90°-2°)}{\cos(90°-2°}\right)\left(\frac{\sin(90°-1°)}{\cos(90°-1°)}\right)$ $= \left(\frac{\sin 1°}{\cos 1°}\right)\left(\frac{\sin 2°}{\cos 2°}\right)\ldots\ldots\left(\frac{\sin 45°}{\cos 45°}\right)\ldots\ldots\left(\frac{\cos 2°}{\sin 2°}\right)\left(\frac{\cos 1°}{\sin 1°}\right)$ $= \tan 45°$ $= 1$ **OR** $\tan 89° = \cot 1° \quad \tan 88° = \cot 2° \ldots$ $\therefore$ product is $(\tan 1°.\cot 1°)(\tan 2°.\cot 2°)\ldots(\tan 44°.\cot 44°).\tan 45°$ $= 1 \times 1 \times 1 \times \ldots \times 1 = 1$	✓ identity ✓ co-ratios ✓ simplification ✓ for answer (4) ✓ identity ✓ co-ratios ✓ simplification ✓ for answer (4) **[29]**

QUESTION 12

12	In Δ CBG and ΔCDH: $CG^2 = x^2 + y^2$ Pythagoras $CH^2 = x^2 + y^2$ Pythagoras In ΔFAE $AE^2 = x^2 + x^2$ $= 2x^2$ $= GH^2$ In Δ CGH $GH^2 = CG^2 + CH^2 - 2\ CG.CH.\cos GCH$ $\cos G\hat{C}H = \dfrac{CG^2 + CH^2 - GH^2}{2CG.CH}$ $\cos G\hat{C}H = \dfrac{x^2 + y^2 + x^2 + y^2 - 2x^2}{2\sqrt{x^2 + y^2}.\sqrt{x^2 + y^2}}$ $\cos G\hat{C}H = \dfrac{2y^2}{2(x^2 + y^2)}$ $\cos G\hat{C}H = \dfrac{y^2}{x^2 + y^2}$	✓ CG^2 ✓ CH^2 ✓ AE^2 ✓ $AE^2 = GH^2$ ✓ use of cos rule ✓ manipulation of formula ✓ substitution ✓ $\cos G\hat{C}H = \dfrac{2y^2}{2(x^2 + y^2)}$ (8) **[8]**

TOTAL: 150