DBE

MATHEMATICS

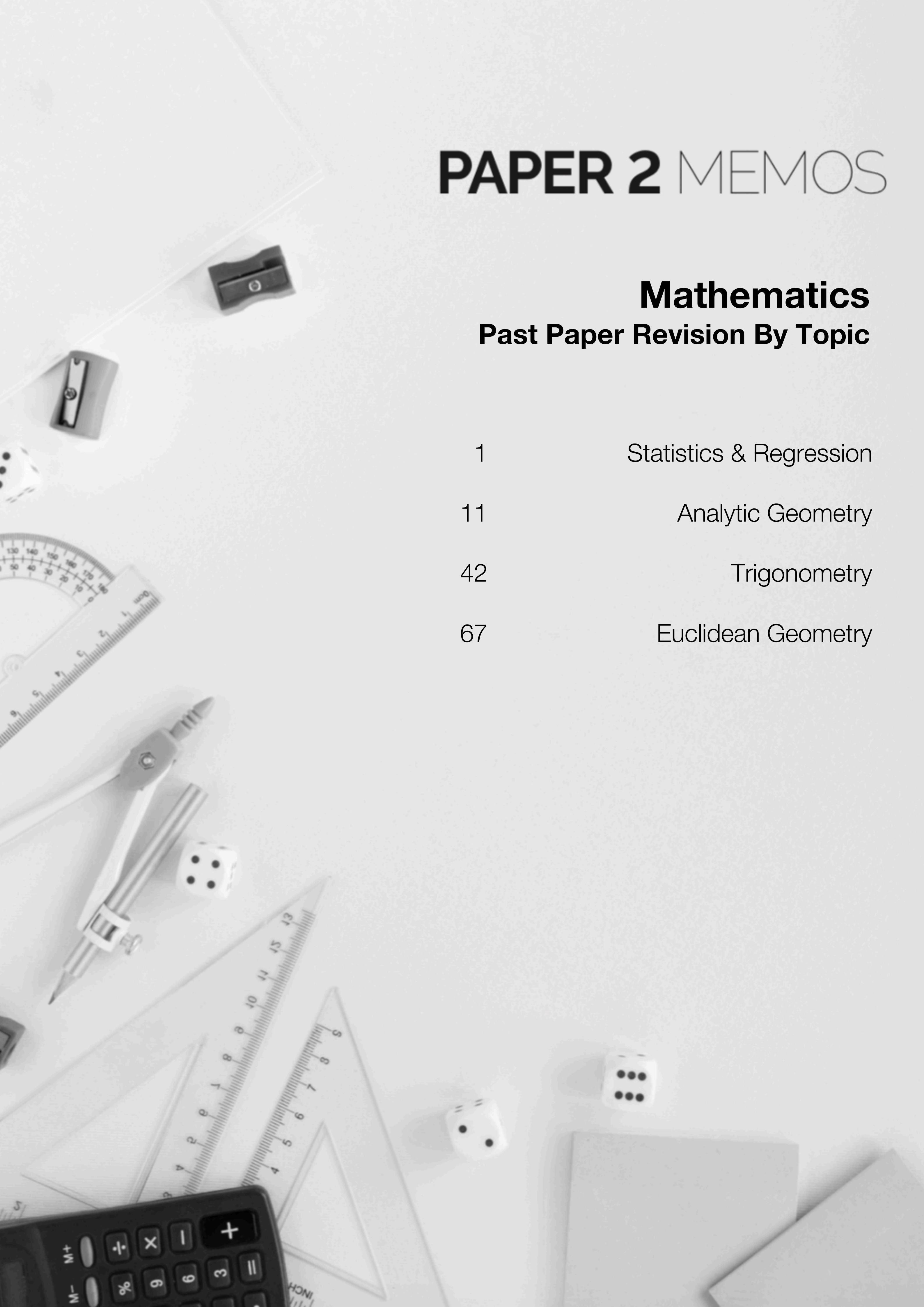
PAST PAPER BOOKLET 2020

Past Paper Memos
By Topic

PAPER 2

AngloAmerican
PLATINUM

XLEducation



PAPER 2 MEMOS

Mathematics

Past Paper Revision By Topic

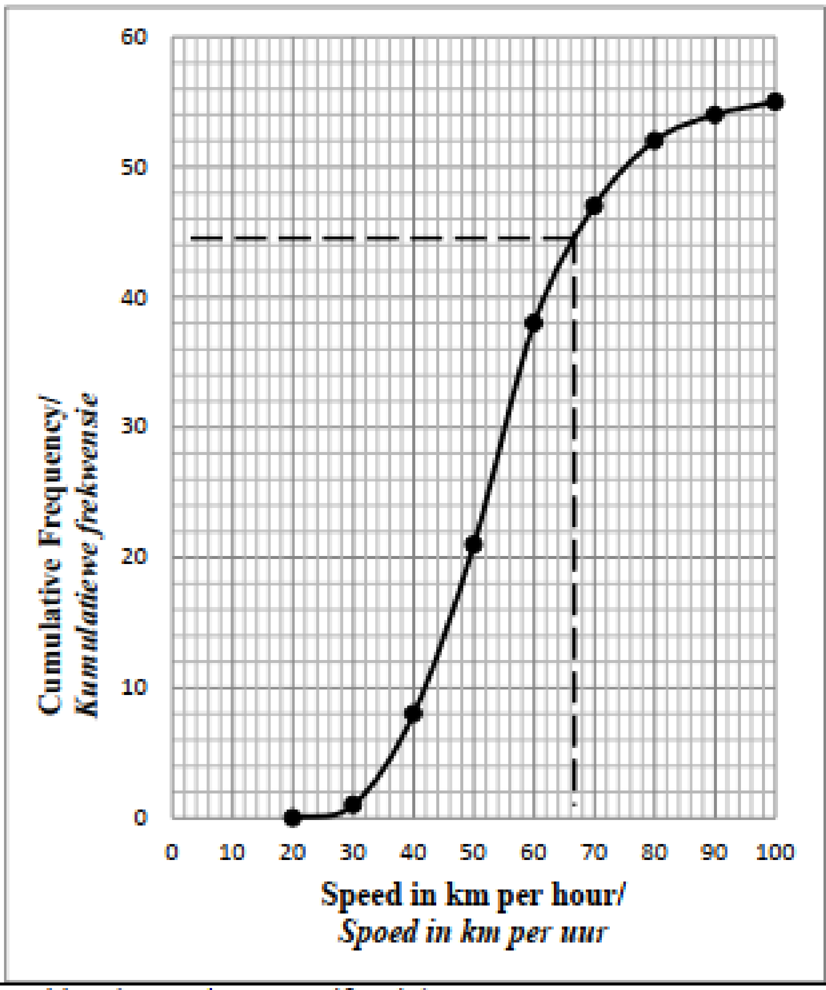
Question 1 **November 2014**

1.1	$\bar{x} = \frac{816}{12} = 68$	✓ $\frac{816}{12}$ ✓ 68 (2)
1.2	$\sigma = 18,42$	✓ answer/*antw* (1)
1.3	(68 – 18,42 ; 68 + 18,42) = (49,58 ; 86,42) $\therefore$ 6 candidates had a mark within one standard deviation of the mean/*6 kandidate het 'n punt binne een standaardafwyking vanaf die gemiddelde.*	✓✓ interval ✓ answer/*antw* (3)
1.4	$a = 22,828... = 22,83$ $b = 0,66429... = 0,66$ $\therefore \hat{y} = 0,66x + 22,83$ **OR/*OF*** $\hat{y} = 22,83 + 0,66x$	✓ value of *a*/ *waarde van a* ✓ value of *b*/ *waarde van b* ✓ equation/*vgl* (3)
1.5	$\hat{y} = 0,66x + 22,83$ $y = 0,66(60) + 22,83$ 62,43...% ≈ 62% **OR/*OF*** 62,69% ≈ 63%	✓ subs of 60 into equation ✓ answer/*antw* (2) ✓✓ answer/*antw* (2)
1.6	(82 ; 62)	✓ answer/*antw* (1) **[12]**

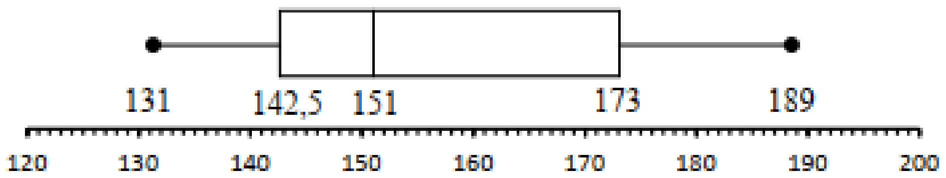
Question 2 **November 2014**

2.1	$50 < x \leq 60$ **OR/*OF*** $50 \leq x < 60$ **OR/*OF*** between 50 and 60/*tussen 50 en 60*	✓ answer/*antw* (1)
2.2.1	(see table below)	✓ 8 ✓ 55 (2)

Class *Klas*	**Frequency** *Frekwensie*	**Cumulative frequency** *Kumulatiewe frekwensie*
$20 < x \leq 30$	1	1
$30 < x \leq 40$	7	8
$40 < x \leq 50$	13	21
$50 < x \leq 60$	17	38
$60 < x \leq 70$	9	47
$70 < x \leq 80$	5	52
$80 < x \leq 90$	2	54
$90 < x \leq 100$	1	55

2.2.2		✓ grounding at (20 ; 0)/ *anker by* (20 ; 0) ✓ plotting at upper limits/ *plot by boonste limiete* ✓ smooth shape of curve/*gladde kurwe* (3)
2.3	55 – 44 (accept/*aanvaar* 43 – 45) ≈ 11 motorists/*motoriste* (accept/*aanvaar* 10 – 12 motorists/*motoriste*)	✓ 44 ✓ 11 (2) **[8]**

Question 1 **Feb March 2015**

1.1	$\bar{x} = \frac{3310}{21}$ $= 157{,}62$ Answer only: Full marks *slegs antw: volpunte*	✓ $\frac{3310}{21}$ ✓157,62 (2)
1.2	(131 ; 142,5 ; 151 ; 173 ; 189)	✓ 131 and/*en* 189 ✓ 142,5 ✓ 173 ✓ 151 (4)
1.3		✓box/*mond* ✓ whiskers/*snor* (2)

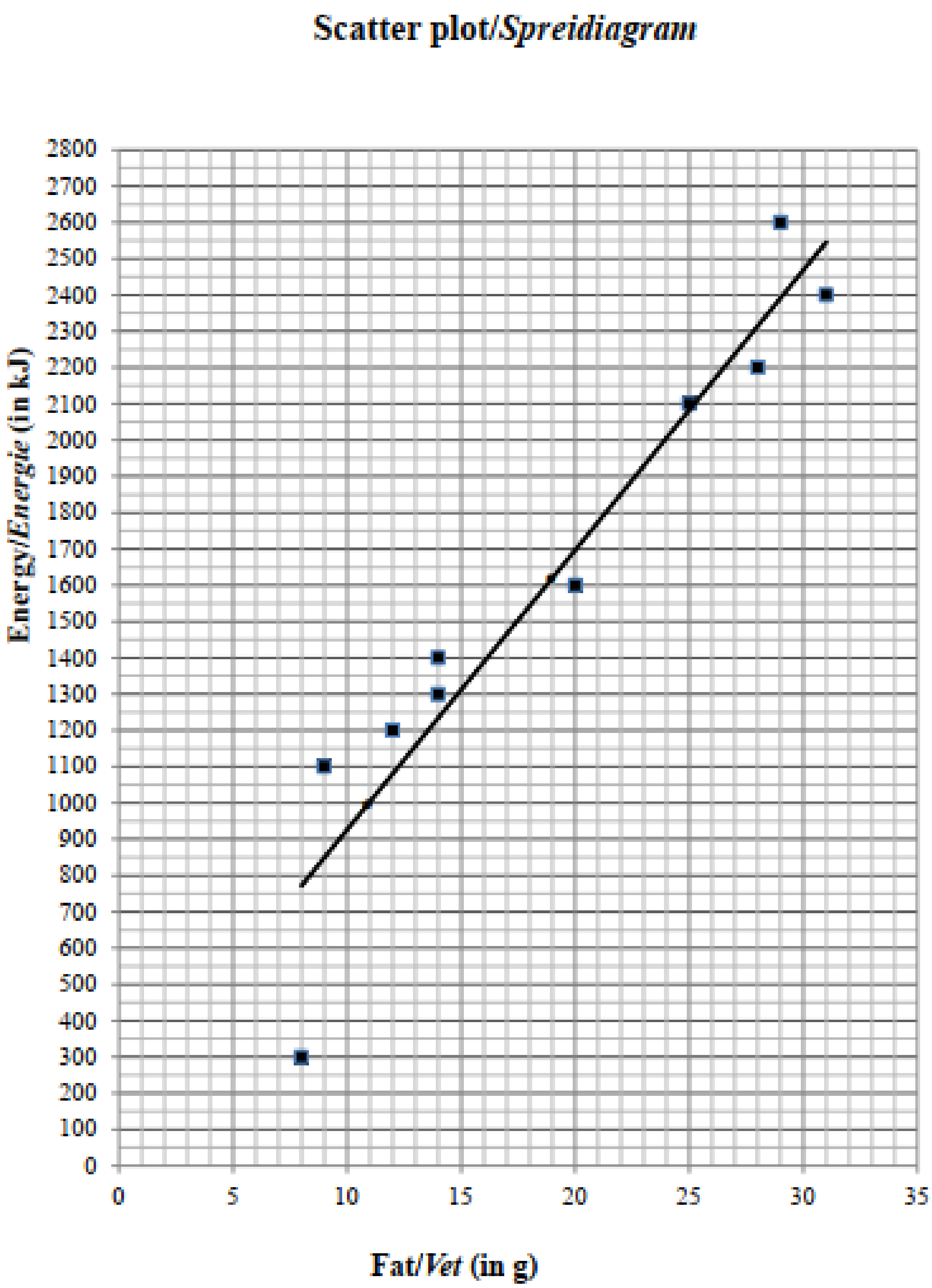
1.4	positively skewed/*positief skeef* **OR/*OF*** skewed to the right/*skeef na regs*	✓ answer/ *antwoord* (1)
1.5	σ = 17,27	✓✓answer/ *antwoord* (2)
1.6.1	$\bar{x} = 157,62 + p$	✓ answer (1)
1.6.2	σ = 17,27	✓ answer/ *antwoord* (1) **[13]**

Question 2 **Feb March 2015**

2.1	As the temperature increases, the sales of ice-creams increase/*Soos die temperatuur styg, neem die verkope toe.* **OR/*OF*** As the temperature decreases, the sales of ice-creams decrease/*Soos die temperatuur daal, neem die verkope af.*	✓ reason/*rede* (1) ✓ reason/*rede* (1)
2.2	The liveable temperature cannot keep on increasing/*Die leefbare temperatuur kan nie aanhou styg nie.*	✓ reason/*rede* (1)
2.3	$a = -460,35$ $b = 30,09$ $\hat{y} = 30,09x - 460,35$ **OR/*OF*** $\hat{y} = -460,35 + 30,09x$ Answer only: Full marks *slegs antw: volpunte*	✓✓ –460,35 ✓ 30,09 ✓ equation/*vgl* (4)
2.4	r = 0,96	✓ 0,96 (1)
2.5	There is a very strong positive relationship (correlation)/*Daar is 'n baie sterk positiewe verband (korrelasie).*	✓ very strong/*baie sterk* (1) **[8]**

Question 1 **November 2015**

Fat/*Vet* (in g)	9	14	25	8	12	31	28	14	29	20
Energy/*Energie* (in kJ)	1 100	1 300	2 100	300	1 200	2 400	2 200	1 400	2 600	1 600

1.1 1.2.2		<u>1.1</u> no marks: 0 – 2 points correctly ✓plotting 3 – 5 points correctly ✓✓plotting 6 – 9points correctly ✓✓✓plotting all 10 points correctly *geen punte: 0 – 2 punte korrek* ✓ *stip 3 – 5 pte korrek* ✓✓*stip 6 –9 pte korrek* ✓✓✓ *stip al 10 pte korrek* (3) <u>1.2.2</u> ✓ y – int close to (0 ; 150) ✓ one pt close to (25 ; 2100) or (20 ; 1700) (2)

1.2.1	$\hat{y} = 154{,}60 + 77{,}13(18)$ $= 1\ 542{,}94 \approx 1\ 500$ kJ	✓ subst ✓ answ rounded off correctly/ *antw korrek afgerond* (2)
1.3	(8 ; 300)	✓ answ/*antw* (1)

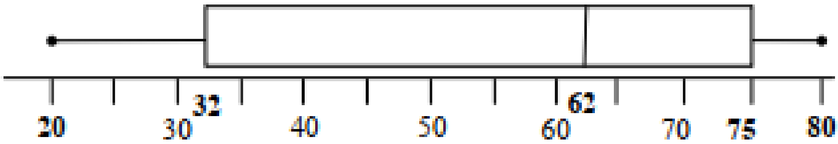
1.4	$r = 0{,}9520... \approx 0{,}95$	✓✓ answ/*antw* (2)
1.5	very strong positive relationship/ *baie sterk positiewe verband*	✓ strong/ *sterk* (1) **[11]**

Question 2 **November 2015**

Sum of the values on uppermost faces/ *Som van die waardes op boonste vlakke*	Frequency/ *Frekwensie*
2	0
3	3
4	2
5	4
6	4
7	8
8	3
9	2
10	2
11	1
12	1

2.1	mean/*gemiddelde* $= \frac{2(0)+3(3)+4(2)+...12(1)}{30} = \frac{202}{30}$ $= 6{,}73$	✓202 ✓ answ/*antw* (2)
2.2	median/*mediaan* $= \frac{T_{15}+T_{16}}{2} = \frac{7+7}{2} = 7$	✓✓ answ/*antw* (2)
2.3	SD/*SA* $= 2{,}264... \approx 2{,}26$	✓✓ answ/*antw* (2)
2.4	$(6{,}73 - 2{,}26\ ;\ 6{,}73 + 2{,}26)$ $= (4{,}47\ ;\ 8{,}99)$ $\therefore 4 + 4 + 8 + 3 = 19$ times/*keer*	✓lower boundary ✓upper boundary ✓ answ/*antw* (3) **[9]**

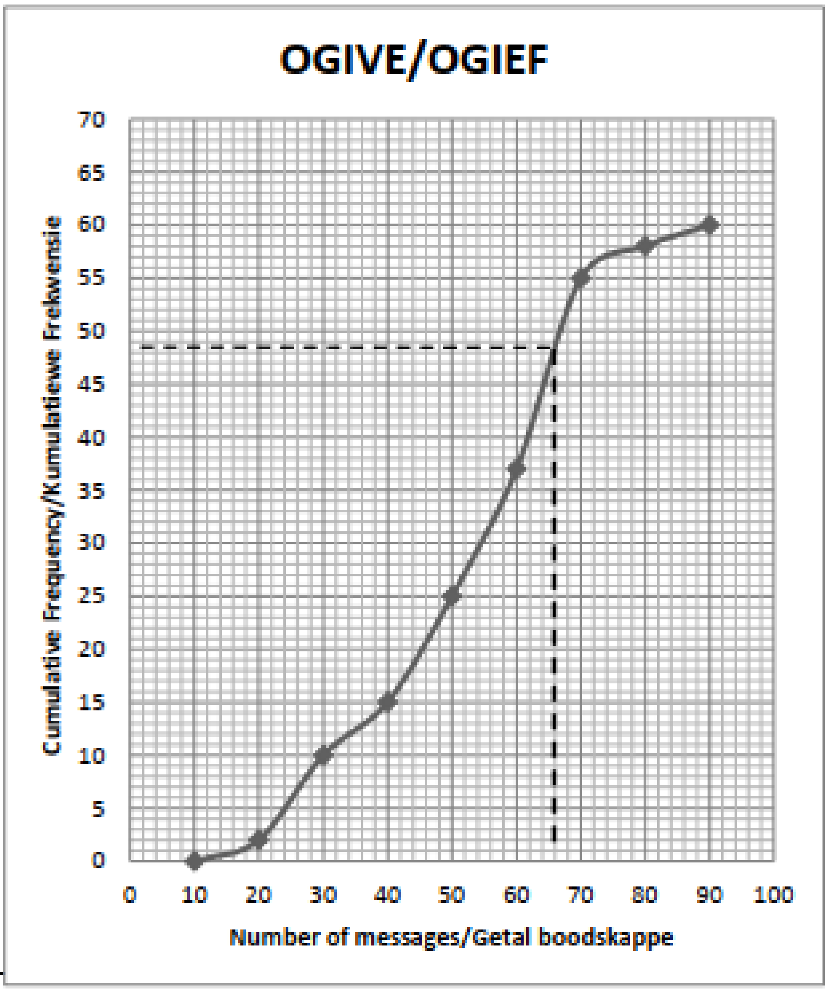
Question 1 **Feb March 2016**



1.1	The data is skewed to the left/*Die data is skeef na links.* **OR/*OF*** The data is negatively skewed/*Die data is negatief skeef.*	✓answ/*antw* ✓answ/*antw* (1)
1.2	Range/*Omvang* = 80 – 20 = 60	✓ max. – min. ✓answ/*antw* (2)
1.3	25% of the learners failed/*van die leerders het gedruip*	✓ ✓answ/*antw* (2)
1.4	$54 = \frac{445 + T_4}{9}$ $T_4 = 41$ **20** | 28 | 36 | **41** | **62** | 69 | **75** | **75** | **80**	✓ 20 ✓✓ 41 ✓ 62 ✓ 75 ✓ 80 (6) **[11]**

Question 2 **Feb March 2016**

2.1	Mean/*Gemiddelde* $= \frac{2(15) + 8(25) + ...2(85)}{60} = \frac{3080}{60}$ = 51,33 messages per day/*boodskappe per dag*	✓ 3 080 ✓ $\frac{3080}{60}$ ✓answ/*antw* (3)

<table>
<tr><td>2.2</td><td>
</td><td>✓grounding at (10 ; 0)
✓plotting at upper limits
✓plotting cumulative f
✓smooth shape of curve

✓geanker by (10 ; 0)
✓stip by boonste limiete
✓plot kumulatiewe f
✓gladde vorm van kurwe
(4)</td></tr>
<tr><td>2.3</td><td>Number of days/Getal dae = 60 – 46 (see on graph above/sien op grafiek hierbo)

= 14 days/dae

OR/OF

Number of days/Getal dae = $2 + 3 + \frac{1}{2} \times 18 = 14$ days/dae</td><td>✓46
(accept 45 – 49)
✓answ/antw
(accept 11 – 15)
(2)

✓add correct values/tel korrekte waardes by
✓answ/antw
(2)
[9]</td></tr>
</table>

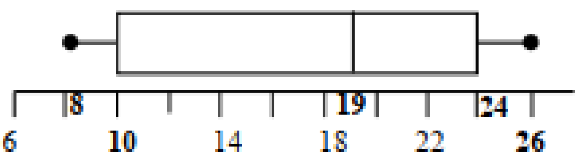
Question 1 **May June 2016**

8	8	10	12	16	19	20	21	24	25	26

<table>
<tr><td>1.1</td><td>Mean/Gemiddelde $= \frac{189}{11}$
$= 17{,}18$

Answer only: Full marks
Slegs antwoord: Volpunte</td><td>✓189

✓ answer
(2)</td></tr>
</table>

1.2	Min = 8, max = 26 Median/*Mediaan* = 19 $Q_1 = 10$, $Q_3 = 24$ $\therefore$ (8 ; 10 ; 19 ; 24 ; 26)	✓ min, max ✓ median ✓ Q_1 & Q_3 (3)
1.3		✓ box/*boks/mond* ✓ whiskers/*snor* (2)
1.4	The data is skewed to the left/*Die data is skeef na links.* **OR/*OF*** Negatively skewed/*Negatief skeef*	✓ answer (1) ✓ answer (1)
1.5	SD/*SA* = 6,46	✓✓ answer (2)
1.6	17,18 + 6,46 = 23,64 $\therefore$ 3 destinations/*bestemmings*	✓ interval ✓ answer (2) **[12]**

Question 2 **May June 2016**

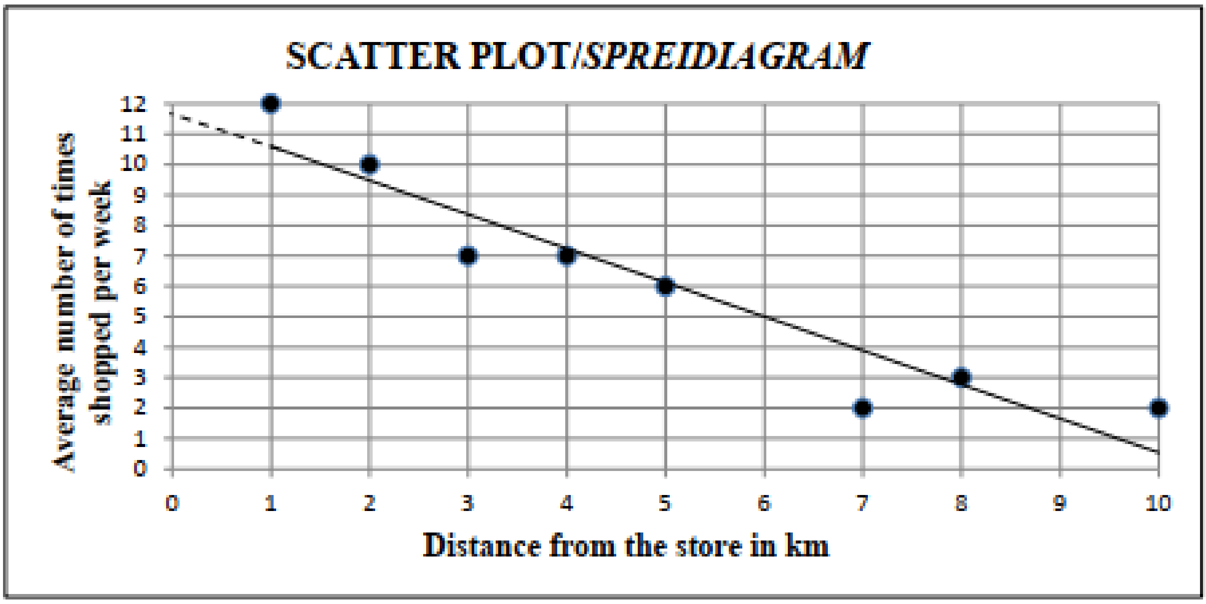
Temperature at midday (in °C) ***Middaguur-temperatuur (in °C)***	18	21	19	26	32	35	36	40	38	30	25
Number of bottles of water (500 mℓ) ***Getal bottels water (500 mℓ)***	12	15	13	31	46	51	57	70	63	53	23

2.1	(30 ; 53)	✓answer (1)
2.2	$a = -38{,}51$ $b = 2{,}68$ $\therefore \hat{y} = 2{,}68x - 38{,}51$	✓ value a ✓ value b ✓ equation (3)
2.3	$\therefore \hat{y} \approx 36{,}53$ bottles **OR/*OF*** $\hat{y} \approx 2{,}68(28) - 38{,}51$ $\approx 36{,}53$ bottles	✓✓ answer (2) ✓ substitution ✓ answer (2)

2.4	Strong/*Sterk* The majority of the points lie **close to** the regression line./*Die meerderheid punte lê naby die regressielyn.* **OR/*OF*** Strong/*Sterk* $r = 0,98$	✓ strong/*sterk* ✓ reason/*rede* (2) ✓ strong/*sterk* ✓ reason/*rede* (2)
2.5	Temperature cannot rise beyond a certain point as this would be life threatening **OR** there is only so much water one can consume before it becomes a risk to your health (hyponatremia)./*Temperatuur kan nie hoër as 'n sekere punt styg nie, anders raak dit lewensgevaarlik.* ***OF*** *'n persoon kan net 'n sekere hoeveelheid water inneem, anders raak dit 'n gesondheidsrisiko*	✓ reason/*rede* (1) **[9]**

Question 1 **November 2016**

Distance from the store in km / *Afstand vanaf die winkel in km*	1	2	3	4	5	7	8	10
Average number of times shopped per week / *Gemiddelde aantal keer wat kopers die winkel per week besoek*	12	10	7	7	6	2	3	2



1.1	Strong/*Sterk*	✓ (1)
1.2	$-0,95$ $(-0,9462..)$	✓ (1)
1.3	$a = 11,71$ $(11,7132...)$ $b = -1,12$ $(-1,1176...)$ $\hat{y} = -1,12x + 11,71$	✓ value of a ✓ value of b ✓ equation/*vgl* (3)
1.4	$\hat{y} = -1,12(6) + 11,71$ $= 5$ times	✓ substitution ✓ answer (2)

1.5	On scatter plot/*Op spreidiagram*	✓✓ A line close to any 2 of the following points: (5 ; 6) or (10 ; $\frac{1}{2}$) or (6 ; 5) or (0 ; 11,7)

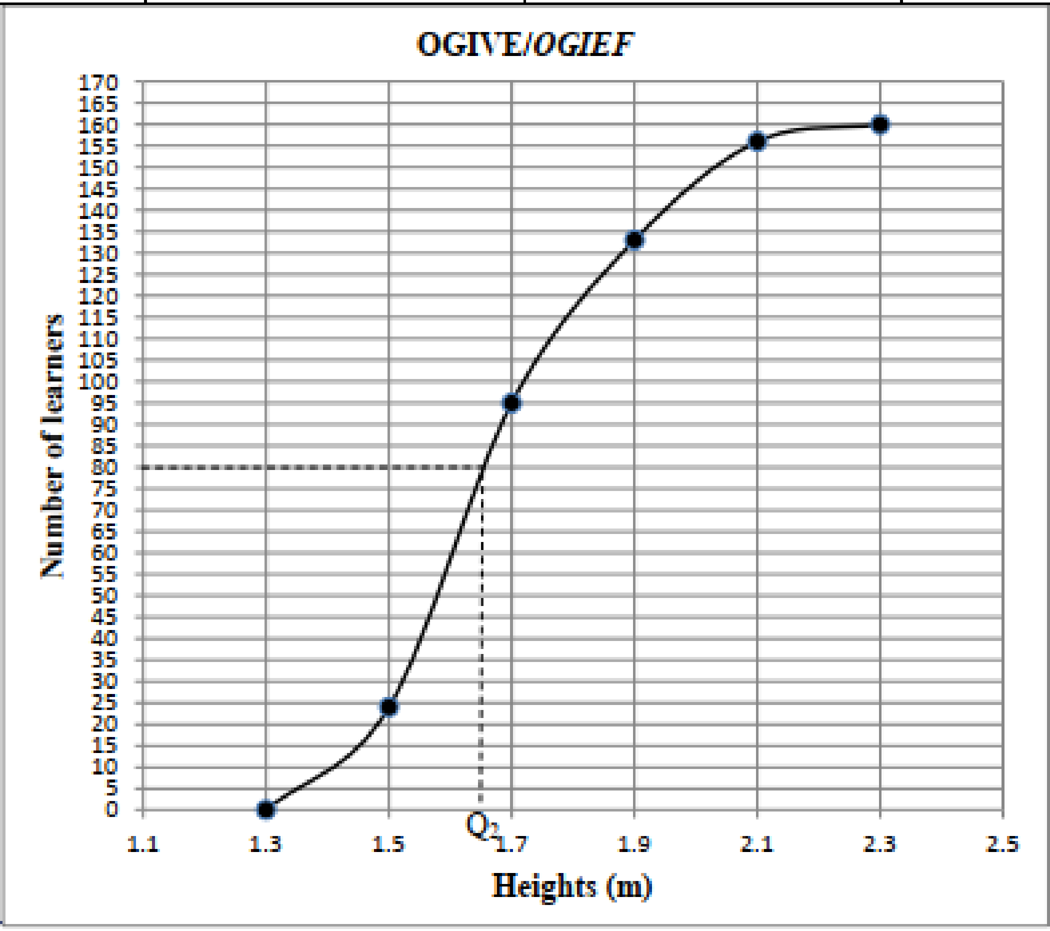
Question 2 **November 2016**

2.1	Positively skewed **OR** skewed to the right/*positief skeef* ***OF*** *skeef na regs*	✓ answer (1)
2.2	Range/*Omvang* = 2,21 – 1,39 = 0,82 m	✓ subtract values ✓answer (2)
2.3	(see table below)	✓95 , 133, 156 ✓160 (2)
2.4	(see ogive below)	✓ upper limits / *boonste limiete* ✓ cum *f*/ *kum f* ✓ shape/ *vorm* ✓ grounded *geanker* (4)
2.5	method (using 80 to determine the height) 1,65 (accept any value between 1,6 and 1,69)	✓ method ✓ answer (2)
2.6.1	The mean would change by 0,1 *m* *Die gemiddelde sal met 0,1 m verander*	✓ answer (1)
2.6.2	No influence/change as there is no difference in variation of data./*Geen invloed /verandering aangesien daar geen verskil in die variasie van die data is nie.*	✓ answer (1) **[13]**

2.3

Intervals ***Klasse***	**Cumulative frequency** ***Kumulatiewe frekwensie***
$1,3 \leq x < 1,5$	24
$1,5 \leq x < 1,7$	95
$1,7 \leq x < 1,9$	133
$1,9 \leq x < 2,1$	156
$2,1 \leq x < 2,3$	160

2.4



Question 3 **November 2014**

3.1	$r = MN = 5$	✓ answer/*antw* (1)
3.2	$(x-5)^2 + (y-4)^2 = 25$	✓equation/*vgl* (1)
3.3	A(x ; 0) $(x-5)^2 + (0-4)^2 = 25$ $x^2 - 10x + 25 + 16 = 25$ $x^2 - 10x + 16 = 0$ $(x-8)(x-2) = 0$ $\therefore x = 8$ or/*of* $x = 2$ $\therefore$ A(2 ; 0) **OR/*OF*** $(x-5)^2 + (0-4)^2 = 25$ $(x-5)^2 + 16 = 25$ $(x-5)^2 = 9$ $(x-5) = \pm 3$ $\therefore x = 8$ or/*of* $x = 2$ $\therefore$ A(2 ; 0)	✓ substitute into eq/ *vervang in vgl* $y = 0$ ✓ standard form/ *standaardvorm* or perfect square form/*kwadr vorm* ✓ answer/*antw* (3)
3.4.1	$m_{MB} = \frac{4-0}{5-8}$ $= -\frac{4}{3}$	✓ subst M and B into form/*vervang M and B in form* ✓ $m_{MB} = -\frac{4}{3}$ (2)
3.4.2	$m_{MB} \times m_{PB} = -1$ (tangent ⊥ radius/ *rkl ⊥ radius*) $m_{PB} = \frac{3}{4}$ $y = \frac{3}{4}x + c$ $0 = \frac{3}{4}(8) + c$ $y = \frac{3}{4}x - 6$ **OR/*OF*** $y - y_1 = \frac{3}{4}(x - x_1)$ $y - 0 = \frac{3}{4}(x-8)$ $y = \frac{3}{4}x - 6$	✓ $m_{MB} \times m_{PB} = -1$ ✓ $m_{PB} = \frac{3}{4}$ ✓ equation/*vgl* (3)
3.5	$y_K = y_M + r = 4 + 5$ $y = 9$	✓ 9 ✓ equation/*vgl* (2)
3.6	At/*By* L: $\frac{3}{4}x - 6 = 9$ $3x - 24 = 36$ $3x = 60$ $x = 20$ $\therefore$ L(20 ; 9)	✓ equating simultaneously ✓ simplification (2)

3.7	L(20 ; 9) $ML = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ **OR/OF** $ML = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(20-5)^2 + (9-4)^2}$ $\quad = \sqrt{(15)^2 + (5)^2}$ $= \sqrt{225 + 25}$ $\quad = \sqrt{(5)^2(9+1)}$ $= \sqrt{250}$ *or / of* $5\sqrt{10}$ $\quad = \sqrt{250}$ *or / of* $5\sqrt{10}$	✓ correct subst into distance formula/ *korrekte subst in afstand-formule* ✓ answer in surd form/*antw in wortelvorm* (2)
3.8	**MK ⊥ KL OR/OF** $\mathbf{M\hat{K}L} = 90°$ (radius ⊥ tangent/*radius ⊥ rkl*) ∴ML is a diameter as it subtends a right angle/*ML is middellyn* $r = \frac{ML}{2} = \frac{\sqrt{250}}{2} = \sqrt{\frac{125}{2}}$ or 7,91 Centre of circle = midpoint of ML/*Midpt van sirkel = midpt v ML* $x = \frac{5+20}{2} = \frac{25}{2} = 12{,}5$ $\quad y = \frac{4+9}{2} = \frac{13}{2} = 6{,}5$ Centre/*midpt*: (12,5 ; 6,5) Equation of the circle KLM /*Vgl van sirkel KLM*: $\therefore \quad (x-12{,}5)^2 + (y-6{,}5)^2 = \frac{250}{4} = \frac{125}{2} = 62{,}5$ **OR/*OF***	✓ S ✓ value of/*waarde van r* ✓ $x = 12{,}5$ ✓ $y = 6{,}5$ ✓ answer in correct form/ *antw in korrekte vorm* (5)
	MK ⊥ KL OR/OF $\mathbf{M\hat{K}L} = 90°$ (radius ⊥ tangent/*radius ⊥ rkl*) ∴ML is a diameter as it subtends a right angle/*ML is middellyn* Centre of circle = midpoint of ML/*Midpt van sirkel = midpt v ML* $x = \frac{5+20}{2} = \frac{25}{2} = 12{,}5$ $\quad y = \frac{4+9}{2} = \frac{13}{2} = 6{,}5$ Centre/*midpt*: (12,5 ; 6,5) Equation of the circle KLM /*Vgl van sirkel KLM*: $(x-12{,}5)^2 + (y-6{,}5)^2 = r^2$ subst (5 ; 4): $(5-12{,}5)^2 + (4-6{,}5)^2 = r^2$ $62{,}5 = r^2$ $\therefore \quad (x-12{,}5)^2 + (y-6{,}5)^2 = \frac{250}{4} = \frac{125}{2} = 62{,}5$ **OR/*OF***	✓ S ✓ $x = 12{,}5$ ✓ $y = 6{,}5$ ✓ value of/*waarde van* r^2 ✓ answer in correct form/*antw in korrekte vorm* (5)

	By symmetry about LM/*deur simmetrie om LM*: **MK ⊥ KL OR/OF** $M\hat{K}L = 90°$ (radius ⊥ tangent/*radius ⊥ rkl*) ∴ ML is a diameter as it subtends a right angle/*ML is middellyn* ML is a diameter /*ML is 'n middellyn* $r = \frac{ML}{2} = \frac{\sqrt{250}}{2} = \sqrt{\frac{125}{2}}$ or /of 7,91 Centre of circle = midpoint of ML/*Midpt van sirkel = midpt v ML* $x = \frac{5+20}{2} = \frac{25}{2} = 12{,}5$ $y = \frac{4+9}{2} = \frac{13}{2} = 6{,}5$ Centre/*midpt*: (12,5 ; 6,5) Equation of the circle KLM /*Vgl van sirkel KLM*: $\therefore (x-12{,}5)^2 + (y-6{,}5)^2 = \frac{250}{4} = \frac{125}{2} = 62{,}5$	✓ S ✓ value of/*waarde van r* ✓ $x = 12{,}5$ ✓ $y = 6{,}5$ ✓ answer in correct form/*antw in korrekte vorm* (5) **[21]**

Question 4 **November 2014**

4.1	$y = 0$: $3x + 8 = 0$ $x = -\frac{8}{3}$ $\therefore E\left(-2\frac{2}{3};0\right)$ **OR/OF** $E\left(-\frac{8}{3};0\right)$	✓ y-value/*waarde* ✓ x-value/*waarde* (2)
4.2	$\tan D\hat{E}O = m_{DE} = 3$ $\therefore D\hat{E}O = 71{,}565... = 71{,}57°$ $D\hat{A}E = 71{,}565...° - 45°$ $= 26{,}57°$	✓ $\tan D\hat{E}O = 3$ ✓ 71,565…° ✓ 26,57° (3)
4.3	$m_{AB} = \tan 26{,}57°$ $= \frac{1}{2}$ $y = \frac{1}{2}x + c$ **OR/OF** $y - y_1 = \frac{1}{2}(x - x_1)$ $5 = \frac{1}{2}(1) + c$ $y - 5 = \frac{1}{2}(x-1)$ $y = \frac{1}{2}x + 4\frac{1}{2}$ $y = \frac{1}{2}x + \frac{9}{2}$	✓ $m_{AB} = \tan 26{,}57°$ ✓ $m_{AB} = \frac{1}{2}$ ✓ subst of m and (1 ; 5) into formula/ *subst m en (1 ; 5) in formule* ✓ equation/*vgl* (4)

4.4	Solve $x - 2y + 9 = 0$ and $y = 3x + 8$ simultaneously: $x - 2(3x+8) + 9 = 0$ $x - 6x - 16 + 9 = 0$ $-5x = 7$ $x = -1\frac{2}{5}$ $\therefore y = 3(-1\frac{2}{5}) + 8$ **OR/*OF*** $-1\frac{2}{5} - 2y + 9 = 0$ $y = 3\frac{4}{5}$ $y = 3\frac{4}{5}$ $\therefore D(-1\frac{2}{5}\ ;\ 3\frac{4}{5})$	✓ subst/*vervang* ✓ x-value/*waarde* ✓ subst/*vervang* ✓ y-value/*waarde* (4)
	OR/OF $x = 2y - 9$ $y = 3(2y - 9) + 8$ $y = 6y - 27 + 8$ $\therefore y = 3\frac{4}{5}$ $x = 2(3\frac{4}{5}) - 9$ **OR/OF** $3\frac{4}{5} = 3x + 8$ $x = -1\frac{2}{5}$ $x = -1\frac{2}{5}$ $\therefore D(-1\frac{2}{5}\ ;\ 3\frac{4}{5})$	✓ subst/*vervang* ✓ y value/*waarde* ✓ subst/*vervang* ✓ x-value/*waarde* (4)
	OR/*OF* $3x + 8 = \frac{1}{2}x + 4\frac{1}{2}$ $6x + 16 = x + 9$ $5x = -7$ $\therefore x = -1\frac{2}{5}$ $\therefore y = 3(-1\frac{2}{5}) + 8$ **OR/*OF*** $y = \frac{1}{2}(-1\frac{2}{5}) + 4\frac{1}{2}$ $y = 3\frac{4}{5}$ $y = 3\frac{4}{5}$ $\therefore D(-1\frac{2}{5}\ ;\ 3\frac{4}{5})$	✓ equating/*gelyk stel* ✓ x value/*waarde* ✓ subst/*vervang* ✓ y-value/*waarde* (4)
	OR/*OF*	

	$x-2y=-9$ ......(1) $-6x+2y=16$ ......(2) (1) + (2): $-5x\quad=7$ $\therefore x=-1\frac{2}{5}$ $\therefore -1\frac{2}{5}-2y=-9$ **OR/*OF*** $y=3(-1\frac{2}{5})+8$ $y=3\frac{4}{5}$ $\quad$ $y=3\frac{4}{5}$ $\therefore D(-1\frac{2}{5}\ ;\ 3\frac{4}{5})$ **OR/*OF*** $y=3x+8$ ....(1) $6y=3x+27$ ....(2) (1) – (2): $-5y\ =\ -19$ $\therefore\ y=3\frac{4}{5}$ $3\frac{4}{5}=3x+8$ **OR/*OF*** $x=2(3\frac{4}{5})-9$ $x=-1\frac{2}{5}$ $\quad$ $x=-1\frac{2}{5}$ $\therefore D(-1\frac{2}{5}\ ;\ 3\frac{4}{5})$	✓ adding/*optelling* ✓ x-value/*waarde* ✓ subst/*vervang* ✓ y-value/*waarde* (4) ✓ subtracting/*aftrekking* ✓ y-value/*waarde* ✓ subst/*vervang* ✓ x-value/*waarde* (4)
4.5	area DMOE = area ΔAMO – area ΔADE $x_A=2(0)-9\quad\therefore A(-9\ ;\ 0)$ area ΔAMO $=\frac{1}{2}.AO.OM$ $=\frac{1}{2}(9)(4\frac{1}{2})$ $=20{,}25$ area ΔADE $=\frac{1}{2}.AE.y_D$ $=\frac{1}{2}.(AO-EO).y_D$ $=\frac{1}{2}\left(9-2\frac{2}{3}\right)\left(3\frac{4}{5}\right)$ $=12{,}03$ **OR/OF** area ΔADE $=\frac{1}{2}AD.AE.\sin D\hat{A}E$ $=\frac{1}{2}(\frac{19\sqrt{5}}{5}).6\frac{1}{3}.\sin 26{,}57°$ $=12{,}03$ $\therefore$ area DMOE = 8,22 square units/*vk eenh* **OR/*OF***	✓ correct method/ *korrekte metode* ✓ $x_A=-9$ ✓ $\frac{1}{2}(9)(4\frac{1}{2})$ ✓ $AE=9-2\frac{2}{3}=6\frac{1}{3}$ ✓ $y_D=3\frac{4}{5}$ **OR/OF** ✓ $AD=\frac{19\sqrt{5}}{5}$ ✓ $AE=6\frac{1}{3}$ ✓ answer/*antw* (6)

	area DMOE = area rectangle DCOG + area ΔDMG + area ΔDEC $= (1\frac{2}{5} \times 3\frac{4}{5}) + \frac{1}{2}\left(1\frac{2}{5}\right)(\frac{7}{10}) + \frac{1}{2}(3\frac{4}{5})(\frac{19}{15})$ = 8,22 square units/*vk eenh*	✓ correct method/ *korrekte metode* ✓ $3\frac{4}{5}$ ✓ $1\frac{2}{5}$ ✓ 0,7 ✓ $\frac{19}{15}$ ✓ answer (6)
	OR/*OF*	
	area DMOE = area ΔEDO + area ΔODM $= \frac{1}{2}(EO \times y_D) + \frac{1}{2}(OM \times -x_D)$ $= \frac{1}{2}\left[\left(\frac{8}{3}\times\frac{19}{5}\right)+\left(\frac{9}{2}\times\frac{7}{5}\right)\right]$ $= \frac{1}{2}\left(\frac{304+189}{30}\right)$ $= \frac{493}{60}$ or/*of* $8\frac{13}{60}$ or/*of* 8,22 square units/*vk eenh*	✓ correct method/ *korrekte metode* ✓ $y_D = \frac{19}{5}$ or $3\frac{4}{5}$ ✓ $EO = \frac{8}{3}$ ✓ $-x_D = \frac{7}{5}$ ✓ $OM = \frac{9}{2}$ or $4\frac{1}{2}$ ✓ answer/*antw* (6)
	OR/*OF*	
	area DMOE = area ΔEOF − area ΔDMF $= \frac{1}{2}(EO \times OF) - \frac{1}{2}(OF - OM)(-x_D)$ $= \frac{1}{2}\left[\left(\frac{8}{3}\times 8\right)+\left(\frac{7}{2}\times\frac{7}{5}\right)\right]$ $= \frac{1}{2}\left(\frac{640-147}{30}\right)$ $= \frac{493}{60}$ or $8\frac{13}{60}$ or 8,22 square units/*vk eenh*	✓ correct method/ *korrekte metode* ✓ $y_F = 8$ ✓ $EO = \frac{8}{3}$ ✓ $-x_D = \frac{7}{5}$ ✓ $FM = 3\frac{1}{2}$ ✓ answer/*antw* (6)
	OR/*OF*	

	area $\Delta EOM = \frac{1}{2}(EO \times OM)$ $= \frac{1}{2}\left(\frac{8}{3} \times \frac{9}{2}\right)$ $= 6$ sq units/*vk eenh* $ED = \sqrt{\left(-\frac{7}{5}+\frac{8}{3}\right)^2+\left(\frac{19}{5}\right)^2}$ and $DM = \sqrt{\left(\frac{7}{5}\right)^2+\left(\frac{9}{2}-\frac{19}{5}\right)^2}$ $= \frac{19\sqrt{10}}{15}$ or 4,005... $\quad = \frac{7\sqrt{5}}{10}$ or 1,565.. area $\Delta EDM = \frac{1}{2}(ED \times DM \times \sin E\hat{D}M)$ $= \frac{1}{2}\left(\frac{19\sqrt{10}}{15}\right)\left(\frac{7\sqrt{5}}{10}\right)\sin 135°$ $= \frac{133}{60}$ or 2,216... $\therefore$ area DMOE = area ΔEOM + area ΔEDM $= 6 + 2{,}216...$ $= \frac{493}{60}$ or/*of* $8\frac{13}{60}$ or/*of* 8,22 square units/*eenh*^{2}	✓ area ΔEOM ✓ $ED = \frac{19\sqrt{10}}{15}$ ✓ $DM = \frac{7\sqrt{5}}{10}$ ✓ area ΔEDM ✓ correct method/ *korrekte metode* ✓ answer/*antw* (6) **[19]**

Question 3 **Feb March 2015**

3.1	$PQ = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ $= \sqrt{(5+1)^2+(13-5)^2}$ $= 10$	✓ use of distance formula/*gebruik afstandformule* ✓ correct subst into form/*korrekte subst in formule* ✓ 10 (3)
3.2	$m_{PQ} = \frac{y_2-y_1}{x_2-x_1}$ $= \frac{13-5}{5-(-1)}$ $= \frac{8}{6} = \frac{4}{3}$ Answer only: Full marks *slegs antw: volpunte*	✓ correct subst into gradient formula/ *korrekte subst in gradiëntformule* ✓ gradient/*gradiënt* (2)

3.3	Equation of line RS/*Vgl van lyn RS*: $m_{RS} = m_{PQ} = \frac{4}{3}$ (= gradients, || lines/=*gradiënte*, || *lyne*) $y = mx + c$ $8 = \frac{4}{3}\left(\frac{15}{2}\right) + c$ $c = -2$ $y = \frac{4}{3}x - 2$ $\therefore 4x - 3y - 6 = 0$ **OR/*OF*** $y - y_1 = m(x - x_1)$ $y - 8 = \frac{4}{3}\left(x - \frac{15}{2}\right)$ $y = \frac{4}{3}x - 2$ $\therefore 4x - 3y - 6 = 0$	✓ $m_{RS} = \frac{4}{3}$ ✓ subst of S(7,5 ; 8) and m into eq /*subst van S(7,5 ; 8) en m in vgl* ✓ value of c /*waarde van c* or/of st form/*st vorm* ✓ equation/*vgl* (4)
3.4	B is the x-intercept of/*is die x-afsnit van* $y = \frac{4}{3}x - 2$ $0 = \frac{4}{3}x - 2$ $4x - 6 = 0$ $x = \frac{3}{2}$ **OR/*OF*** $4x - 3(0) - 6 = 0$ $4x - 6 = 0$ $x = \frac{3}{2}$	✓ $y = 0$ ✓ $x = \frac{3}{2}$ (2)
3.5	$\tan\ \alpha = \frac{4}{3}$ $\alpha = 53{,}13° = \hat{OBR}$ (vert opp ∠s/*regoorst* ∠*e*) $\hat{ORB} = 180° - (90° + 53{,}13°)$ (∠s of Δ/∠*e van* Δ) $= 36{,}87°$	✓ $\tan\ \alpha = \frac{4}{3}$ ✓ 53,13° ✓ 36,87° (3)
3.6	$BS = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{\left(\frac{15}{2} - \frac{3}{2}\right)^2 + (8 - 0)^2}$ $= 10$ PQ || BS and/*en* PQ = BS PQBS = parallelogram (1 pair opp sides = and ||/*1 pr tos sye =en* ||) **OR/*OF*** midpoint of/*midpt van* QS: $\left(\frac{-1 + 7.5}{2}; \frac{5 + 8}{2}\right) = \left(\frac{13}{4}; \frac{13}{2}\right)$ midpoint of/*midpt van* PB: $\left(\frac{5 + 1.5}{2}; \frac{13 + 0}{2}\right) = \left(\frac{13}{4}; \frac{13}{2}\right)$ PQBS = parallelogram (diags bisect each other/*hoekl halv mekaar)* **OR/*OF***	✓ correct subst into form/*korrekte subst in formule* ✓ BS = 10 ✓ BS = PQ ✓ reason/*rede* (4) ✓ $\left(\frac{-1 + 7.5}{2}; \frac{5 + 8}{2}\right)$ ✓ $\left(\frac{5 + 1.5}{2}; \frac{13 + 0}{2}\right)$ ✓ $\left(\frac{13}{4}; \frac{13}{2}\right)$ ✓ reason/*rede* (4)

	$m_{QB}=\frac{5-0}{-1-1,5}=\frac{5}{-2,5}=-2$ $m_{PS}=\frac{13-8}{5-7,5}=\frac{5}{-2,5}=-2$ $m_{QB}=m_{PS}$ $\therefore$ QB || PS PQ || BS PQBS = parallelogram (both pairs opp sides ||/*beide pr tos sye* ||)	✓ m_{QB} ✓ m_{PS} ✓ QB || PS ✓ reason/*rede* (4)
	OR/*OF* $BS=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ $=\sqrt{\left(\frac{15}{2}-\frac{3}{2}\right)^2+(8-0)^2}$ $\therefore$ PQ = BS $=10$ $QB=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ $=\sqrt{(-1-1,5)^2+(5-0)^2}=\sqrt{(2,5)^2+(5)^2}=\frac{5\sqrt{5}}{2}$ or 5,59 $PS=\sqrt{(5-7,5)^2+(13-8)^2}=\sqrt{(2,5)^2+(5)^2}=\frac{\sqrt{125}}{2}$ or 5,59 QB = PS PQBS = parallelogram (both pairs opp sides =/ *beide pr tos sye* =)	✓ correct subst into form/*korrekte subst in formule* ✓ PQ = 10 ✓ QB = PS ✓ reason/*rede* (4) **[18]**

Question 4 **Feb March 2015**

4.1.1	Radius = $\sqrt{(2+1)^2+(4-2)^2}$ $r=\sqrt{13}$ Equation of circle/*vgl van sirkel*: $(x-2)^2+(y-4)^2=13$	✓ $\sqrt{(2+1)^2+(4-2)^2}$ or/*of* $\sqrt{13}$ ✓ $(x-2)^2+(y-4)^2$ ✓ 13 (3)
	OR/*OF* $(x-2)^2+(y-4)^2=r^2$ $(-1-2)^2+(2-4)^2=r^2$ $r^2=13$ $\therefore (x-2)^2+(y-4)^2=13$	✓ $(x-2)^2+(y-4)^2$ ✓ $(-1-2)^2+(2-4)^2$ ✓ 13 (3)

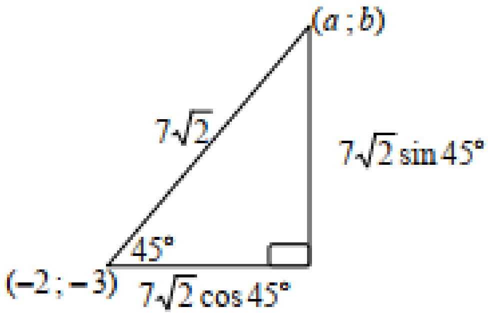
4.1.2	At/*by* D: $\frac{-1+x_D}{2}=2$ $\frac{2+y_D}{2}=4$ $-1+x_D=4$ and/*en* $2+y_D=8$ $x_D=5$ $y_D=6$ D(5 ; 6) **OR/*OF*** By inspection/*deur inspeksie*: D(5 ; 6)	✓ x – value/*waarde* ✓ y - value/*waarde* (2) ✓ x - value/*waarde* ✓ y - value/*waarde* (2)
4.1.3	$m_{MC}=\frac{4-2}{2+1}=\frac{2}{3}$ $m_{AB}\times m_{MC}=-1$ (Tangent ⊥ radius/*raaklyn ⊥ radius*) $m_{AB}=-\frac{3}{2}$ $y-y_1=m(x-x_1)$ **OR/*OF*** $y=mx+c$ $y-2=-\frac{3}{2}(x+1)$ $2=-\frac{3}{2}(-1)+c$ $y=-\frac{3}{2}x+\frac{1}{2}$ $y=-\frac{3}{2}x+\frac{1}{2}$	✓ $m_{MC}=\frac{4-2}{2+1}=\frac{2}{3}$ ✓ $m_{AB}\times m_{MC}=-1$ ✓ $m_{AB}=-\frac{3}{2}$ ✓subst m and (–1 ; 2) into eq /*subst m en (–1 ; 2) in vgl* ✓ eq in standard form/ *vgl in st vorm* (5)
4.1.4	At/*by* E: $(0-2)^2+(y-4)^2=13$ $(y-4)^2=9$ $y-4=\pm3$ $y=7$ or $y=1$ E(0 ; 7) **OR/*OF*** At/*by* E: $(0-2)^2+(y-4)^2=13$ $4+y^2-8y+16=13$ $y^2-8y+7=0$ $(y-7)(y-1)=0$ $y=7$ or $y=1$ E(0 ; 7)	✓ $x=0$ ✓ simplification/ *vereenvoudiging* ✓ y - values/*waardes* ✓ E(0 ; 7) (4) ✓ $x=0$ ✓ simplification/ *vereenvoudiging* ✓ y - values/*waardes* ✓ E(0 ; 7) (4)

4.1.5	$m_{EM} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{4-7}{2-0}$ $= -\frac{3}{2}$ $m_{AB} = -\frac{3}{2}$ $\therefore$ EM || AB $(m_{EM} = m_{AB})$	✓ $m_{EM} = -\frac{3}{2}$ ✓ reason/*rede* (2)
4.2	The centres of the circles are / *Die middelpunte van die sirkels is* P(–2 ; 4) and / *en* Q(5 ; –1) $QP^2 = (-2-5)^2 + (4-(-1))^2$ $QP = \sqrt{74} \approx 8{,}60$ units $r_M + r_P = 5 + 3$ $= 8$ $\therefore\ r_M + r_P < QP$ $\therefore$ The two circles do not intersect/*Die twee sirkels sny nie*	✓ both centres/*albei Midpte* ✓ QP ✓ correct subst into form/*korrekte subst in formule* ✓ distance between 2 centres/*afstand tussen 2 midpte* ✓✓ $r_M + r_P < QP$ (6) **[22]**

Question 3 **November 2015**

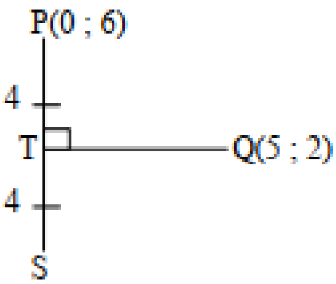
3.1	$m_{PQ} = \tan 45°$ $= 1$	✓ $m = \tan 45°$ ✓ answ/*antw* (2)
3.2	MN || QP [midpt theorem/*midpt-stelling*] $\therefore m_{MN} = 1$ $\therefore y - y_1 = m(x - x_1)$ $\therefore y - 1 = 1(x - 7)$ $\therefore\ y - x - 6$ **OR/*OF*** MN || PQ [midpt theorem/*midpt-stelling*] $\therefore m_{MN} = 1$ $\therefore y = mx + c$ $\therefore 1 = 1(7) + c$ $-6 = c$ $\therefore\ y = x - 6$	✓ S **OR** R ✓ m_{MN} ✓ subst m and/*en* N(7 ; 1) ✓ equation/*vgl* (4) ✓ S **OR** R ✓ m_{MN} ✓ subst m and/*en* N(7 ; 1) ✓ equation/*vgl* (4)
3.3	$MN = \frac{1}{2}PQ$ [midpoint theorem/midp stelling] $\therefore MN = \frac{7\sqrt{2}}{2} \approx 4{,}95$	✓ S ✓ answ/antw (2)

3.5	QN = NS [diag of ||m/hoekl van ||m] $\frac{-2+x_S}{2}=7$ and/en $\frac{-3+y_S}{2}=1$ $\therefore x_S = 16$ $\therefore y_S = 5$ **OR/*OF*** QN = NS [diag of ||m/hoekl van ||m] $\therefore$ by inspection/deur inspeksie: S(16 ; 5)	✓ method/metode ✓ x-value/waarde ✓ y-value/waarde (3) ✓ method/metode ✓ x-value/waarde ✓ y-value/waarde (3)
3.6	Equation of/*Vgl van PQ*: $y = x + c$ $-3 = -2 + c$ $y = x - 1$ $\therefore a = b + 1$ .....(1) From distance formula/*Van afstandsformule*: $PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $7\sqrt{2} = \sqrt{(a-(-2))^2 + (b-(-3))^2}$ $\therefore 98 = (a+2)^2 + (b+3)^2$ ......(2) Subst (1) into (2): $98 = (b+1+2)^2 + (b+3)^2$ $98 = b^2 + 6b + 9 + b^2 + 6b + 9$ $0 = 2b^2 + 12b - 80$ $0 = b^2 + 6b - 40$ $\therefore 0 = (b+10)(b-4)$ $\therefore b = 4$ (since $b > 0$) Subst $b = 4$ into (1): $\therefore a = 4 + 1 = 5$ $\therefore$ P(5 ; 4) **OR/*OF*** Equation of/*Vgl van PQ*: $y = x + c$ $-3 = -2 + c$ $y = x - 1$ $\therefore a = b + 1$ .....(1) From distance formula/*Van afstandsformule*: $7\sqrt{2} = \sqrt{(a-(-2))^2 + (b-(-3))^2}$ $\therefore 98 = (a+2)^2 + (b+3)^2$ ......(2) Subst (1) into (2): $98 = (b+1+2)^2 + (b+3)^2$ $98 = 2(b+3)^2$ $49 = (b+3)^2$ $\pm 7 = b + 3$ $\pm 7 - 3 = b$ $\therefore b = 4$ (since $b > 0$) Subst $b = 4$ into (1): $\therefore a = 4 + 1 = 5$ $\therefore$ P(5 ; 4)	✓ eq of/*vgl van* PQ ✓ subst Q & $7\sqrt{2}$ into/*in* distance formula/ *afstandsformule* ✓ subst eq of/*vgl v.* PQ ✓ st form/*st vorm* ✓ value of/*waarde van b* ✓ value of/*waarde van a* (6) ✓ eq of/*vgl van* PQ ✓ subst Q & $7\sqrt{2}$ into/*in* distance formula/ *afstandsformule* ✓ subst eq of/*vgl v.* PQ ✓ simplification/ *vereenvoudig* ✓ value of/*waarde van b* ✓ value of/*waarde van a* (6)

	OR/*OF* Equation of/*Vgl van PQ*: $y = x + c$ $-3 = -2 + c$ $y = x - 1$ $\quad \therefore a = b + 1$ .....(1) From distance formula/*Van afstandsformule*: $7\sqrt{2} = \sqrt{(a-(-2))^2 + (b-(-3))^2}$ $98 = (a+2)^2 + (a-1+3)^2$ $= 2(a+2)^2$ $\therefore a + 2 = 7$ (since/*aangesien* $a > 0$) $\therefore a = 5$ Subst $a = 4$ into (1): $\therefore b = 5 - 1 = 4$ $\therefore$ P(5 ; 4)	✓ eq of/*vgl van* PQ ✓ subst Q & $7\sqrt{2}$ into/*in* distance formula/ *afstandsformule* ✓ subst eq of/*vgl v.* PQ ✓ simplification/ *vereenvoudig* ✓ value of/*waarde van a* ✓ value of/*waarde van b* (6)
	OR/*OF*  $a = -2 + 7\sqrt{2}\cos 45° = 5$ $b = -3 + 7\sqrt{2}\sin 45° = 4$	✓✓✓✓ ✓ ✓ (6) **[17]**

Question 4 **November 2015**

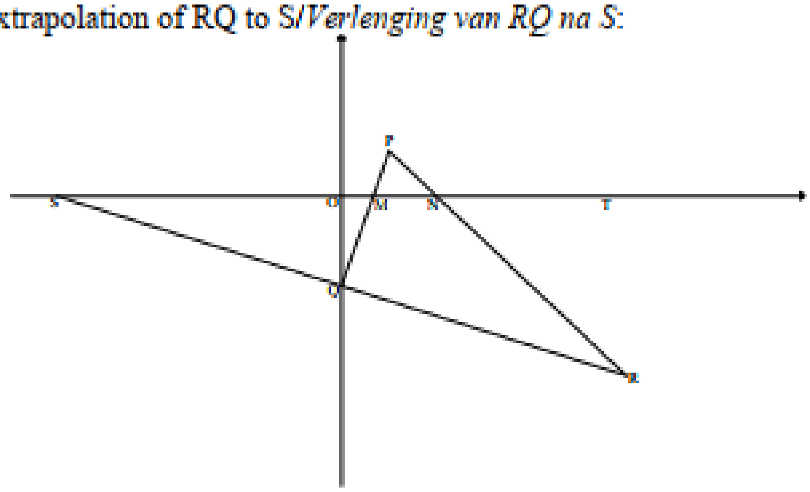
4.1	$(x-5)^2 + (y-2)^2 = r^2$ $(0-5)^2 + (6-2)^2 = r^2$ $25 + 16 = r^2$ $41 = r^2$ $\therefore (x-5)^2 + (y-2)^2 = 41$	✓ subst (5 ; 2) into circle eq/*in sirkelvgl* ✓ value of/*waarde van* r^2 ✓ equation/*vgl* (3)
	OR/*OF* $PQ = \sqrt{(0-5)^2 + (6-2)^2}$ $= \sqrt{25+16}$ $r = \sqrt{41}$ $\therefore (x-5)^2 + (y-2)^2 = 41$	✓ subst (5 ; 2) & (0 ; 6) into dist. form/*in afst. form* ✓ value of/*waarde van r* ✓ equation/*vgl* (3)

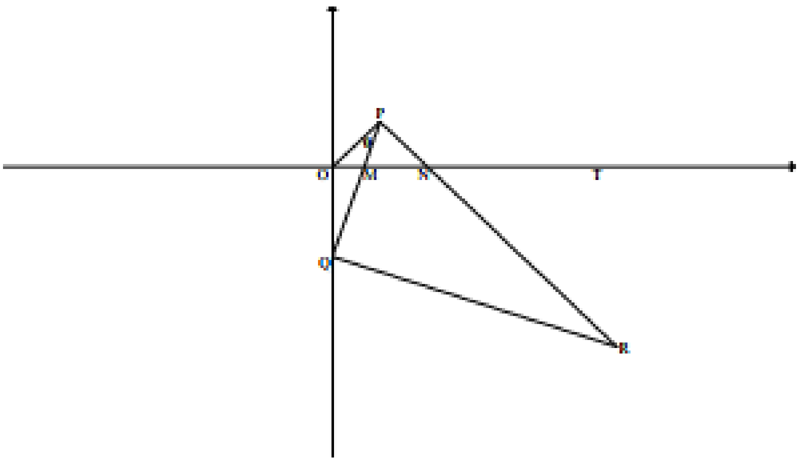
4.2	$(0-5)^2+(y-2)^2 = 41$ $25+(y-2)^2 = 41$ $25+y^2-4y+4 = 41$ $y^2-4y-12=0$ $(y-6)(y+2)=0$ $y \neq 6$ *or / of* $y=-2$ $\therefore$ S(0 ; –2) or $y=-2$	✓ $x=0$ ✓ st form/*st. vorm* ✓ answ/*antw* (neg value) (3)
	OR/*OF*	
	$(0-5)^2+(y-2)^2 = 41$ $25+(y-2)^2 = 41$ $(y-2)^2 = 16$ $y-2 = \pm 4$ $y = 2 \pm 4$ $y \neq 6$ or / *of* $y=-2$ $\therefore$ S(0 ; –2)	✓ $x=0$ ✓ square form/ *kwadraatvorm* ✓ answ/*antw* (neg value) (3)
	OR/*OF* Draw/*Trek* QT ⊥ PS PT = TS [line from centre ⊥ to chord/ *lyn van midpt ⊥ koord*] PT = $y_P - y_Q = 6-2 = 4$ $y_Q - y_S = 4$ $y_S = 2-4=-2$ $\therefore$ S(0 ; –2)  	✓ $x=0$ ✓✓ $y=-2$ (3)
4.3	$m_{PQ} = \frac{6-2}{0-5}$ $= -\frac{4}{5}$ $m_{PQ} \times m_{APB} = -1$ [tan/*raakl* ⊥ radius] $\therefore m_{APB} = \frac{5}{4}$ $\therefore y = \frac{5}{4}x + 6$	✓ subst (0 ; 6) & (5 ; 2) into grad form/*in grad. formule* ✓ m_{PQ} ✓ m_{APB} ✓ equation/*vgl* (4)

4.4	$\tan\alpha = \frac{5}{4}$ $\therefore \alpha = 51,34°$ **OR/*OF*** B(4,8 ; 0) $\therefore \tan\alpha = \frac{6}{4,8}$ $\therefore \alpha = 51,34°$	✓ $\tan\alpha = m_{APB}$ ✓ answ/*antw* (2) ✓ $\tan\alpha = \frac{6}{4,8}$ ✓ answ/*antw* (2)
4.5	$\theta = B\hat{P}S$ [tan-chord th/*raakl-koordst.*] $= 90° - \alpha$ [∠ sum in Δ/∠ *som van* Δ] $= 90° - 51,34°$ $= 38,66°$ **OR/*OF*** PS = 8 $PQ = SQ = \sqrt{41}$ $PS^2 = PQ^2 + SQ^2 - 2.PQ.SQ.\cos P\hat{Q}S$ $64 = 41 + 41 - 2.41.\cos P\hat{Q}S$ $\cos P\hat{Q}S = \frac{18}{82}$ $P\hat{Q}S = 77,32°$ $\theta = \frac{1}{2} P\hat{Q}S$ [∠ at centre = 2 × ∠ circumf] $= 38,66°$	✓ S ✓ R ✓ $90° - \alpha$ ✓ answ/*antw* (4) ✓ correct subst into cosine rule ✓ $P\hat{Q}S = 77,32°$ ✓ R ✓ answ/*antw* (4)
4.6	Area $\Delta PQS = \frac{1}{2} PS \times$ height/*hoogte* $= \frac{1}{2}(8)(5)$ = 20 sq units/*vk eenh* **OR/*OF*** $P\hat{Q}S = 2 \times 38,66°$ [∠at centre = 2×∠ at circum/ *midpts∠=2omtreks∠*] $= 77,32°$ Area $\Delta PQS = \frac{1}{2} PQ.QS.\sin P\hat{Q}S$ $= \frac{1}{2}.\sqrt{41}.\sqrt{41}.\sin 77,32°$ = 20 sq units/*vk eenh*	✓ area formula/*e*: ΔPQS ✓ PS = 8 ✓ ⊥h = 5 ✓ answ/*antw* (4) ✓ size of/*grootte v* $P\hat{Q}S$ ✓ area rule/*reël*: ΔPQS ✓ subst correctly/ *subst korrek* ✓ answ/*antw* (4) **[20]**

Question 3 **Feb March 2016**

3.1	$m_{PQ}=\frac{1-(-2)}{1-0}$ $=3$	✓subst (1 ; 1) & (0 ; –2) ✓answ/*antw* (2)
3.2	QR: $y=-\frac{1}{3}x-2$ $\therefore m_{QR}=-\frac{1}{3}$ $m_{PQ}\times m_{QR}=3\times-\frac{1}{3}$ $=-1$ $\therefore PQ\perp QR$ $\therefore P\hat{Q}R=90°$	✓ $m_{QR}=-\frac{1}{3}$ ✓ $m_{PQ}\times m_{QR}=-1$ (2)
3.3	$-\frac{1}{3}x-2=-x+2$ $\frac{2}{3}x=4$ $x=6$ $y=-4$ $\therefore R(6\,;-4)$	✓equating/*gelyk stel* ✓x-value/*waarde* ✓y-value/*waarde* (3)
3.4	$PR=\sqrt{(1-6)^2+(1-(-4))^2}$ $=\sqrt{50}=5\sqrt{2}$ **OR/*OF*** $PR^2=(1-6)^2+(1-(-4))^2$ $=50$ $\therefore PR=\sqrt{50}=5\sqrt{2}$	✓subst into/*in* distance formula/ *afstandsformule* ✓answ/*antw* in surd form/ *wortelvorm* (2) ✓subst into/*in* distance formula/ *afstandsformule* ✓answ/*antw* in surd form/ *wortelvorm* (2)
3.5	PR is a diameter/ *'n middellyn* [chord subtends/*kd onderspan* 90°] Centre of circle/*Midpt v sirkel*: $\left(\frac{1+6}{2};\frac{1-4}{2}\right)$ $=\left(3\frac{1}{2};-1\frac{1}{2}\right)$ $r=\frac{\sqrt{50}}{2}$ OR $\frac{5\sqrt{2}}{2}$ OR 3,54 $\therefore\left(x-\frac{7}{2}\right)^2+\left(y+\frac{3}{2}\right)^2=\frac{50}{4}$ OR $\frac{25}{2}$ OR 12,5	✓✓S ✓✓ $\left(3\frac{1}{2};-1\frac{1}{2}\right)$ ✓r-value/*waarde* ✓answ/*antw* (6)

3.6	m of/*van* radius $= -1$ $\therefore m$ of/*van* tangent/*raaklyn* $= 1$ Equation of tangent/ *Vgl van raaklyn*: $y - y_1 = (x - x_1)$ **OR/*OF*** $y = x + c$ $y - 1 = x - 1$ $\quad 1 = 1 + c$ $\therefore y = x$ $\quad y = x$	✓ m of tang/*rkl* ✓ subst m & P(1 ; 1) into/*in* eq of line/*vgl v lyn* ✓ answ/*antw* (3)
3.7	$\tan \hat{PNT} = m_{PR} = -1$ $\therefore \hat{PNT} = 135°$ $\tan \hat{PMT} = m_{PQ} = 3$ $\therefore \hat{PMT} = 71{,}57°$ $\hat{P} = 63{,}43°$ [ext ∠ of Δ/*buite ∠ v* Δ] $\therefore \theta = 26{,}57°$ [sum of ∠s in Δ/*som v ∠e in* Δ] **OR/*OF***	✓ $\tan \hat{PNT} = -1$ ✓ $\hat{PNT} = 135°$ ✓ $\hat{PMT} = 71{,}57°$ ✓ $\hat{P} = 63{,}43°$ ✓ answ/*antw* (5)
	Extrapolation of RQ to S/*Verlenging van RQ na S*:  $\tan \hat{PNT} = m_{PR} = -1$ $\therefore \hat{SNR} = 135°$ $\tan \hat{NSR} = m_{RS} = -\frac{1}{3}$ $\therefore \hat{NSR} = 18{,}43°$ $\theta = 180° - (135° + 18{,}43°)$ [sum of ∠s in Δ/*som v ∠e in* Δ] $= 26{,}57°$ **OR/*OF***	✓ $\tan \hat{PNT} = -1$ ✓ $\hat{SNR} = 135°$ ✓ $\tan \hat{NSR} = -\frac{1}{3}$ ✓ $\hat{NSR} = 18{,}43°$ ✓ answ/*antw* (5)

	Solution	Marks
	$PQ^2 = 1^2 + 3^2 = 10$ $PQ = \sqrt{10}$ $\therefore \sin\theta = \frac{PQ}{PR} = \frac{\sqrt{10}}{\sqrt{50}} = \frac{1}{\sqrt{5}}$ $\therefore \theta = 26{,}57°$	✓subst into/*in* distance formula/ *afstandsformule* ✓distance/*afst* PQ ✓correct trig ratio/ *korrekte trig vh* ✓correct trig eq/ *korrekte trig vgl* ✓answ/*antw* (5)
	OR/*OF* $QR^2 = 6^2 + 2^2 = 40$ $QR = 2\sqrt{10}$ $\therefore \cos\theta = \frac{2\sqrt{10}}{\sqrt{50}} = \frac{2}{\sqrt{5}}$ $\therefore \theta = 26{,}57°$	✓subst into/*in* distance formula/ *afstandsformule* ✓distance/*afst* PQ ✓correct trig ratio/ *korrekte trig vh* ✓correct trig eq/ *korrekte trig vgl* ✓answ/*antw* (5)
	OR/*OF* $\tan\theta = \frac{m_{RQ} - m_{PR}}{1 + m_{RQ}.m_{PR}}$ $= \frac{-\frac{1}{3} - (-1)}{1 + (-\frac{1}{3})(-1)}$ $= \frac{1}{2}$ $\therefore \theta = 26{,}57°$	✓correct formula/ *korrekte formule* ✓$m_{RQ} = -\frac{1}{3}$ ✓correct subst/ *subst korrek* ✓$\tan\theta = \frac{1}{2}$ ✓$\theta = 26{,}57°$ (5)
	 tangent OP goes through the origin/*raakl OP gaan deur oorsprong* $P\hat{O}M = 45°$ $O\hat{P}M = \theta = \hat{P}$ [tan-chord theorem/*raakl-kdst*] $\tan P\hat{M}T = m_{PQ} = 3$ $\therefore P\hat{M}T = 71{,}57°$ $\therefore \theta + 45° = 71{,}57°$ [ext ∠ of Δ/*buite-*∠ *v* Δ] $\therefore \theta = 26{,}57°$	✓$P\hat{O}M = 45°$ ✓R ✓$P\hat{M}T = 71{,}57°$ ✓S ✓$\theta = 26{,}57°$ (5) **[23]**

Question 4 **Feb March 2016**

4.1	OR ⊥ TR [radius ⊥ tangent/*raakl*] $\therefore m_{TR} \times m_{OR} = -1$ $\therefore m_{OR} = -2$ $\therefore y = -2x$	✓S/R ✓*m* of/*van* OR ✓equation/*vgl* (3)
4.2	$x^2 + (-2x)^2 = 20$ $x^2 + 4x^2 = 20$ $5x^2 - 20 = 0$ $x^2 - 4 = 0$ $(x+2)(x-2) = 0$ $\therefore x = 2$ $y = -2(2) = -4$ $\therefore$ R(2 ; –4)	✓subst eq of OR into circle eq/ *subst vgl OR in sirkelvgl* ✓st. form/*st. vorm* ✓*x*-value/*waarde* ✓*y*-value/*waarde* (4)
4.3	Subst R(2 ; –4) into the equation of/*in vgl van* PRS: $-4 = \frac{1}{2}(2) + k$ $k = -5$ $\therefore$ OT = 5 $0 = \frac{1}{2}x - 5$ $x = 10$ $\therefore$ OS = 10 Area/*Oppervlakte* $= \frac{1}{2}$OS . OT $= \frac{1}{2}(10)(5)$ = 25 sq units/*vk eenh*	✓correct subst/ *korrekte subst* ✓value of *k* ✓$y = 0$ ✓*x*-intercept/*afsnit* ✓correct subst into area form/ *subst korrek in opp-formule* ✓answ/*antw* (6)
4.4	$0 = \frac{x_V + 2}{2}$ and/*en* $0 = \frac{y_V - 4}{2}$ $\therefore$ V(–2 ; 4) T(0 ; –5) .... from/*van* 4.3 $VT = \sqrt{(-2-0)^2 + (4-(-5))^2}$ $= \sqrt{4+81}$ $= \sqrt{85}$	✓*x*-value/*waarde*V ✓*y*-value/*waarde*V ✓subst of points V and T into distance formula/ *subst punte V en T in afst-form* ✓answ/*antw* (4) **[17]**

Question 3 **May June 2016**

3.1	$m_{AD} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{0-6}{-2+8}$ $= \frac{-6}{6} = -1$	✓substitution ✓-1 (2)
3.2	$m_{BC} = -1$ [BC || AD] $y = -x + c$ $10 = -8 + c$ $c = 18$ $y = -x + 18$ **OR/*OF*** $m_{BC} = -1$ [BC || AD] $y - y_1 = m(x - x_1)$ $y - 10 = -(x - 8)$ $y = -x + 18$	✓ gradient ✓substitute m and (8 ; 10) ✓ equation (3) ✓ gradient ✓substitute m and (8 ; 10) ✓ equation (3)
3.3	$m_{BD} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{10-0}{8+2} = 1$ $m_{BD} \times m_{AD} = 1 \times -1 = -1$ $\therefore DB \perp AD$ **OR** $AD^2 = 72$ *or* $AD = \sqrt{72}$ *or* $6\sqrt{2}$ $AB^2 = 272$ *or* $AB = \sqrt{272}$ *or* $4\sqrt{17}$ $BD^2 = 200$ *or* $BD = \sqrt{200}$ *or* $10\sqrt{2}$ $\therefore AB^2 = AD^2 + BD^2$ $\therefore A\hat{D}B = 90°$ [converse Pyth th/ *omgekeerde Pyth st*]	✓substitution ✓ answer ✓ $m_{BD} \times m_{AD} = -1$ (3) ✓✓ calculating all 3 sides ✓ $AB^2 = AD^2 + BD^2$ (3)
3.4	$\tan B\hat{D}M = m_{BD} = 1$ $\therefore B\hat{D}M = 45°$ **OR** $\sin B\hat{D}M = \frac{BM}{BD} = \frac{10}{10\sqrt{2}} = \frac{1}{\sqrt{2}}$ $\therefore B\hat{D}M = 45°$	✓ $\tan B\hat{D}M = m_{BD}$ ✓ answer (2) ✓ $\sin B\hat{D}M = \frac{1}{\sqrt{2}}$ ✓ answer (2)

3.5	$T(x;y)=\left(\frac{x_1+x_2}{2};\frac{y_1+y_2}{2}\right)$ $=\left(\frac{-2+8}{2};\frac{0+10}{2}\right)$ $=(3;5)$ T symmetrical about BM/*T is simmetries om BM* $\therefore$ distance of T to BM = 5 units = distance from BM to C $\therefore$ C(13 ; 5) **OR/*OF***	✓T(3 ; 5) ✓value of x ✓ value of y (3)
	$m_{DF}=\frac{3\frac{1}{3}-0}{8-(-2)}=\frac{1}{3}$ <u>Equation of DF:</u> $y-y_1=m(x-x_1)$ $y-0=\frac{1}{3}(x+2)$ $y=\frac{1}{3}x+\frac{2}{3}$ <u>Equation of BC:</u> $y=-x+18$ $\frac{1}{3}x+\frac{2}{3}=-x+18$ $4x=52$ $x=13$ $\therefore y=-13+18=5$ $\therefore$ C(13 ; 5)	✓eq of DF ✓value of x ✓ value of y (3)
3.6	area/*opp* ΔBDF = area/*opp* ΔBDM − area/*opp* ΔDFM $=\frac{1}{2}(10)(10)-\frac{1}{2}(10)\left(\frac{10}{3}\right)$ $=\frac{100}{3}$ or $33\frac{1}{3}$ or 33,3 square units/*vk eenh* **OR/*OF*** area/*opp* ΔBDF $=\frac{1}{2}$BF.DM $=\frac{1}{2}\left(\frac{20}{3}\right)(10)$ $=\frac{100}{3}$ or $33\frac{1}{3}$ or 33,3 square units/*vk eenh* **OR/*OF***	✓ formula/method ✓ 10 (DM) ✓ 10 (BM) ✓ $\frac{10}{3}$ or $3\frac{1}{3}$ ($\perp$h) ✓ answer (5) ✓ formula/method ✓ BF ✓✓ DM ✓ answer (5)

	$\tan F\hat{D}M = m_{DC} = \frac{5-0}{13+2} = \frac{1}{3}$ or $\tan F\hat{D}M = \frac{FM}{DM} = \frac{\frac{10}{3}}{10} = \frac{1}{3}$	✓ gradient/ratio
	$F\hat{D}M = 18{,}43°$	
	$\therefore B\hat{F}D = 108{,}43°$ [ext ∠ Δ]	✓ $B\hat{F}D$
	$BF = \frac{20}{3}$ or $6\frac{2}{3}$	
	$DF^2 = (10)^2 + \left(3\frac{1}{3}\right)^2$ [Pyth ΔDFM]	✓ DF
	$DF = 10{,}54$ or $\frac{\sqrt{1000}}{3}$ or $\frac{10\sqrt{10}}{3}$	
	$BD = \sqrt{(10-0)^2 + (8+2)^2}$ $= \sqrt{200}$ *or* $10\sqrt{2}$	
	$\therefore$ area/*opp* $\Delta BDF = \frac{1}{2} BF.FD.\sin B\hat{F}D$	
	$= \frac{1}{2}\left(\frac{20}{3}\right)\left(\frac{10\sqrt{10}}{3}\right)(\sin 108{,}43)$	✓correct substitution into area rule
	$= \frac{100}{3}$ or $33\frac{1}{3}$ or 33,33 square units/*vk eenh*	✓ answer (5)
	OR/*OF*	
	$BF = \frac{20}{3}$ or $6\frac{2}{3}$	✓ BF
	$BD = \sqrt{(10-0)^2 + (8+2)^2}$	
	$= \sqrt{200}$ *or* $10\sqrt{2}$	✓ BD
	area/*opp* $\Delta BDF = \frac{1}{2} BF.BD.\sin D\hat{B}F$	✓ formula/method
	$= \frac{1}{2}\left(\frac{20}{3}\right)\left(\sqrt{200}\right)(\sin 45°)$	✓correct substitution into area rule
	$= \frac{100}{3}$ or $33\frac{1}{3}$ or 33,33 square units/*vk eenh*	✓ answer (5)
	OR/*OF*	
	area/*opp* ΔBDF	
	= area/*opp* ΔBCD – area/*opp* ΔBCF	✓ formula/method
	$= \frac{1}{2}(10\sqrt{2})(5\sqrt{2}) - \frac{1}{2}\left(\frac{20}{3}\right)(5)$	✓ $BD = 10\sqrt{2}$ ✓ $BC = 5\sqrt{2}$ ✓ $BF = \frac{20}{3}$
	$= \frac{100}{3}$ or $33\frac{1}{3}$ or 33,33 square units/*vk eenh*	✓ answer (5)
	OR/*OF*	

	$\tan F\hat{D}M = m_{DC} = \frac{5-0}{13+2} = \frac{1}{3}$ or $\tan F\hat{D}M = \frac{FM}{DM} = \frac{\frac{10}{3}}{10} = \frac{1}{3}$ $F\hat{D}M = 18{,}43°$ $B\hat{D}F = 26{,}56°$ area / *opp* ΔBDF $= \frac{1}{2}.BD.DF.\sin B\hat{D}F$ $= \frac{1}{2}.(10\sqrt{2})\left(\frac{10\sqrt{10}}{3}\right).\sin 26{,}56°$ $= \frac{100}{3}$ or $33\frac{1}{3}$ or 33,33 square units/*vk eenh*	✓ gradient/ratio ✓ $B\hat{D}F$ ✓ DF **OR/*OF*** BD ✓correct substitution into area rule ✓ answer (5) **[18]**

Question 4 **May June 2016**

4.1	radius ⊥ tangent /*raaklyn*	✓ R (1)
4.2	$CR^2 = TR^2 + CT^2$ (Pyth) $CR^2 = 20^2 + 10^2 = 500$ $CR = \sqrt{500}$ or $10\sqrt{5}$	✓ substitution ✓ answer (2)
4.3	$CR^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$ $500 = (k-3)^2 + (21+1)^2$ $k^2 - 6k + 9 + 484 = 500$ $k^2 - 6k - 7 = 0$ $(k-7)(k+1) = 0$ $k = 7$ or $k \neq -1$ **OR/*OF*** $CR^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$ $500 = (k-3)^2 + (21+1)^2$ $(k-3)^2 = 16$ $k - 3 = 4$ or $k - 3 = -4$ $k = 7$ or $k \neq -1$	✓ substitution ✓ standard form ✓ factors ✓ $k = 7$ (4) ✓ substitution ✓ square form ✓ square root ✓ $k = 7$ (4)

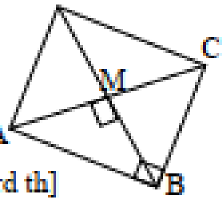
4.4	$(x-3)^2+(y+1)^2=100$	✓✓ answer (2)
4.5	CS = 10 and CS ⊥ PS $\therefore S(3;-11)$ $\therefore y=-11$	✓ $S(3;-11)$ ✓ answer (2)
4.6.1	S(3;–11) $\therefore 3(-11)-4x=35$ $x=-17$ $\therefore P(-17;-11)$ **OR/*OF*** $\frac{4}{3}x+\frac{35}{3}=-11$ $\frac{4}{3}x=\frac{-68}{3}$ $x=-17$ $P(-17;-11)$	✓ substituting ✓ answer (2) ✓ equating ✓ answer (2)
4.6.2	PT = PS [tangents from common point/*rklyne vanaf dies pt*] = 17 + 3 = 20 units **OR** $PC=\sqrt{(-17-3)^2+(-11+1)^2}$ $=\sqrt{500}$ *or* $10\sqrt{5}$ $PT^2=PC^2-TC^2$ [Pyth th] $=500-100$ $=400$ $\therefore PT=20$ **OR** $PC=\sqrt{(-17-3)^2+(-11+1)^2}$ $=\sqrt{500}$ *or* $10\sqrt{5}$ $\Delta PTC\equiv\Delta RTC$ [90°HS] $\therefore PT=TR$ $\therefore PT=20$	✓ S ✓R ✓ answer (3) ✓ value of PC ✓ using Pyth ✓ answer (3) ✓ value of PC ✓ S/R or proved ✓ answer (3)
4.7.1	$M(3;-16)$	✓answer (1)

4.7.2	Radius = 4	✓ answer (1)
4.7.3	$r_1 + r_2 = 10 + 4 = 14$ distance $CM = \sqrt{(3-3)^2 + (-1+16)^2}$ $= \sqrt{225}$ $= 15$ $CM > r_1 + r_2$ Therefore the two circles do not intersect or touch./*Daarom sny of raak die twee sirkels nie.*	✓ $r_1 + r_2$ ✓ 15 ✓explanation (3) **[21]**

Question 3 **November 2016**

3.1	M = Midpt of AC [diags of rectangle bisect/ *hoekl v reghoek halveer*] $= M\left(\frac{-7+6}{2} ; \frac{2+3}{2}\right)$ $= M\left(-\frac{1}{2} ; \frac{5}{2}\right)$	✓ x-value of M ✓ y-value of M (2)
3.2	$m_{BC} = \frac{3-0}{6-p} = \frac{3}{6-p}$ **OR/OF** $m_{BC} = \frac{0-3}{p-6} = \frac{-3}{p-6}$	✓answer (1) ✓answer (1)
3.3	$m_{AD} = m_{BC}$ [AD || BC] $m_{BC} = 2$ $\frac{3}{6-p} = 2$ $3 = 12 - 2p$ $p = 4\frac{1}{2}$ **OR/OF** $y - y_1 = 2(x - x_1)$ $C(6;3)$ $y - 3 = 2(x-6)$ $\therefore y = 2x - 9$ *but* $y = 0$ $\therefore x = 4\frac{1}{2} = p$ **OR/OF**	✓ $m_{BC} = 2$ ✓ equating ✓answer (3) ✓ $m_{BC} = 2$ ✓ substituting (6 ; 3) ✓answer (3)

	$y = 2x + c$ $3 = 12 + c$ $-9 = c$ $y = 2x - 9$ $0 = 2x - 9$ $x = \frac{9}{2} \qquad \therefore p = \frac{9}{2}$	✓ $m_{BC} = 2$ ✓ substituting ✓answer (3)
3.4	DB = AC [diag of rectangle = / *hoekl v reghoek* =] $AC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $AC = \sqrt{(6+7)^2 + (3-2)^2}$ $AC = \sqrt{13^2 + 1^2}$ $AC = \sqrt{170}$ $\therefore DB = \sqrt{170}$ or 13,04	✓ substitution ✓ length of AC ✓ AC = BD (3)
3.5	$\tan\alpha = m_{BC} = 2$ $\therefore \alpha = 63{,}43°$	✓ $\tan\alpha = m_{BC}$ ✓ $\alpha = 63{,}43°$ (2)
3.6	In quadrilateral OFBG: $O\hat{F}B = 63{,}43°$ [vert opp ∠s/*regoorst* ∠*e*] $F\hat{O}G = G\hat{B}F = 90°$ $\therefore O\hat{G}B = 360° - [90° + 90° + 63{,}43°]$ [sum ∠s quad/*som* ∠*e vierh* = 360°] $\therefore O\hat{G}B = 116{,}57°$ **OR/*OF*** $m_{AB} = -\frac{1}{2}$ $90° + O\hat{G}A = 153{,}43°$ $\therefore O\hat{G}A = 63{,}43°$ $O\hat{G}B = 180° - 63{,}43°$ $= 116{,}57°$ **OR/*OF*** $F\hat{O}G = G\hat{B}F = 90°$ ∴GOFB is cyc quad $O\hat{G}B = 180° - 63{,}43°$ [∠s of cyc quad = 180°] $= 116{,}57°$ **OR/OF** $O\hat{F}B = 63{,}43°$ $X\hat{O}G = F\hat{B}G = 90°$ ∴ OGBF is a cyclic quad $\therefore O\hat{G}B = 180° - 63{,}43°$ $O\hat{G}B = 116{,}57°$	✓ size of $O\hat{F}B$ ✓ S ✓ answer (3) ✓ $m_{AB} = -\frac{1}{2}$ ✓ S ✓ answer (3) ✓ S ✓ S ✓ answer (3) ✓ S ✓ S ✓ answer (3)

3.7	$M\left(-\frac{1}{2};\frac{5}{2}\right)$ is the centre/*is die middelpunt* $r=\frac{\sqrt{170}}{2}$ = radius [BD is diameter/*middellyn*] $\left(x+\frac{1}{2}\right)^2+\left(y-\frac{5}{2}\right)^2=\left(\frac{\sqrt{170}}{2}\right)^2=\frac{85}{2}=42{,}5$	✓ M is centre ✓ $r=\frac{\sqrt{170}}{2}$ ✓ equation (3)
3.8	$C\hat{B}M=B\hat{A}M=45°$ [diag of square bisect ∠s/*hoekl v vierk halv ∠e*] ∴ BC will be a tangent [converse tan chord th/*omgekeerde raakl-koordst*] **OR/*OF***  $A\hat{M}B=90°$ [diag of square bisect ⊥] ∴ AB is diameter BC ⊥ AB ∴ BC is tangent [line ⊥ radius *or* converse tan-chord th]	✓S ✓ R (2) ✓S ✓ R (2) **[19]**

Question 4 November 2016

4.1	∠ in semi circle/ ∠ at centre = 2∠ on circle *∠ in halfsirkel* /∠ by middelpt = 2∠ op sirkel	✓ R (1)
4.2	$m_{TS}=\frac{7-2}{3-5}$ $=-\frac{5}{2}$	✓ substitution ✓ m_{TS} (2)
4.3	$m_{TS}\times m_{RS}=-1$ [TS ⊥ SR] $\therefore m_{RS}=\frac{2}{5}$ $y=\frac{2}{5}x+c$ $2=\frac{2}{5}(5)+c$ $c=0$ $y=\frac{2}{5}x$ **OR/*OF***	✓ m_{RS} ✓substitution *m* and (5 ; 2) ✓ equation (3)

	$m_{TS} \times m_{RS} = -1$ [TS ⊥ SR] $\therefore m_{RS} = \frac{2}{5}$ $y - y_1 = \frac{2}{5}(x - x_1)$ $y - 2 = \frac{2}{5}(x - 5)$ $y = \frac{2}{5}x$	✓ m_{RS} ✓substitution m and (5 ; 2) ✓ equation (3)
4.4.1	$r = \sqrt{36\frac{1}{4}}$ $TR = 2r = 2\left(\sqrt{36\frac{1}{4}}\right) = \sqrt{145}$ **OR/OF** $TM = \sqrt{(3-9)^2 + \left(7 - 6\frac{1}{2}\right)^2} = \frac{\sqrt{145}}{2}$ $TR = 2r = 2\left(\sqrt{36\frac{1}{4}}\right) = \sqrt{145}$	✓ r ✓ answer (2) ✓ substitution ✓ answer (2)
4.4.2	$M\left(9 ; 6\frac{1}{2}\right)$ $\therefore \frac{x_R + 3}{2} = 9$ and $\frac{y_R + 7}{2} = 6\frac{1}{2}$ $\therefore R(15 ; 6)$ Answer only: full marks Answer only: only 1 coordinate correct (1 mark) **OR/OF** $M\left(9 ; 6\frac{1}{2}\right)$ $\therefore R\left(9 + 6 ; 6\frac{1}{2} - \frac{1}{2}\right) = R(15 ; 6)$ **OR/OF**	✓ M ✓ x coordinate ✓ y coordinate (3) ✓ M ✓ x coordinate ✓ y coordinate (3)

	$m_{TM} = \dfrac{9-3}{6\frac{1}{2}-7} = -\dfrac{1}{12}$ $TM: \quad 7 = -\dfrac{1}{12}(3) + c \quad y = -\dfrac{1}{12}x + \dfrac{29}{4} \quad$ ....(1) $SR: \quad y = \dfrac{2}{5}x \quad$ ....(2) $\dfrac{2}{5}x = -\dfrac{1}{12}x + \dfrac{29}{4}$ $\dfrac{29}{60}x = \dfrac{29}{4}$ $\therefore x = 15$ $\therefore y = \dfrac{2}{5}(15) = 6$	✓ equating ✓ x coordinate ✓ y coordinate (3)
4.4.3	$ST = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $ST = \sqrt{(5-3)^2 + (2-7)^2}$ $ST = \sqrt{4+25} = \sqrt{29}$ $\sin R = \dfrac{TS}{TR} = \dfrac{\sqrt{29}}{\sqrt{145}}$ *or* $\dfrac{\sqrt{5}}{5}$ *or* $\dfrac{1}{\sqrt{5}}$ *or* $0{,}45$ **OR/OF** $TS = \sqrt{29}$ $SR = 2\sqrt{29}$ area of $\Delta TSR = \dfrac{1}{2}(\sqrt{29})(2\sqrt{29}) = 29$ $29 = \dfrac{1}{2}(\sqrt{145})(2\sqrt{29})\sin R$ $\sin R = \dfrac{\sqrt{5}}{5}$ *or* $\dfrac{1}{\sqrt{5}}$	✓substitution ✓ answer ✓ ratio (3) ✓area ✓ rule ✓ ratio (3)
4.4.4	$m_{TR} = \dfrac{7-6\frac{1}{2}}{3-9} = -\dfrac{1}{12}$ **OR/OF** $m_{TR} = \dfrac{7-6}{3-15} = -\dfrac{1}{12}$ $m_{TR} \times m_{KTL} = -1 \quad$ [$r \perp$ tangent] $m_{KTL} = 12$ $y - y_1 = 12(x - x_1)$ $y - 7 = 12(x-3)$ $y = 12x - 29$ substitute $K(a;b)$: $b = 12a - 29$ **OR/OF**	✓ $m_{TR} = -\dfrac{1}{12}$ ✓ $m_{KTL} = 12$ ✓ $y = 12x - 29$ (3)

	$m_{TR} = \dfrac{7-6\frac{1}{2}}{3-9} = -\dfrac{1}{12}$ $m_{TR} \times m_{KTL} = -1$ [$r \perp$ tangent] $\dfrac{b-7}{a-3} = 12$ $b-7 = 12(a-3)$ $b = 12a-29$ **OR/*OF*** $KR^2 = TR^2 + TK^2$ $(a-15)^2 + (b-6)^2 = (15-3)^2 + (6-7)^2 + (a-3)^2 + (b-7)^2$ $-30a + 225 - 12b + 36 = 144 + 1 - 6a + 9 - 14b + 49$ $2b = 24a - 58$ $b = 12a - 29$	✓ $m_{TR} = -\dfrac{1}{12}$ ✓ $m_{KTL} = 12$ ✓substitution (3 ; 7) & (a ; b) (3) ✓subst into Pyth ✓multiplication ✓simplification (3)
4.4.5	$TK = TR$ $\sqrt{(a-3)^2 + (b-7)^2} = \sqrt{145}$ $(a-3)^2 + (b-7)^2 = 145$ Substitute $b = 12a - 29$ [from 4.4.4] $(a-3)^2 + (12a-29-7)^2 = 145$ $(a-3)^2 + (12a-36)^2 = 145$ $a^2 - 6a + 9 + 144a^2 - 864a + 1296 - 145 = 0$ $145a^2 - 870a + 1160 = 0$ $a = \dfrac{870 \pm \sqrt{(870)^2 - 4(145)(1160)}}{290}$ $a = 2$ or $a = 4$ $\therefore b = 12(2) - 29 = -5$ or $b = 12(4) - 29 = 19$ $\therefore K(2 ; -5)$ **OR/*OF***	✓ substitution into distance formula ✓ substitution of $b = 12a - 29$ ✓standard form ✓ subst into formula or factorise ✓ values of a ✓ value of b (6)

	$TK = TR$ $\sqrt{(a-3)^2+(b-7)^2} = \sqrt{145}$ $(a-3)^2+(b-7)^2 = 145$ Substitute $b = 12a - 29$ [from 4.4.4] $(a-3)^2+(12a-29-7)^2 = 145$ $(a-3)^2+(12a-36)^2 = 145$ $(a-3)^2+144(a-3)^2 = 145$ $(a-3)^2 = 1$ $a-3 = \pm 1$ $a = 2$ or 4 $\therefore b = 12(2) - 29$ or $b = 12(4) - 29$ $= -5$ $= 19$ $\therefore K(2 ; -5)$ **OR/*OF*** $KR^2 = TR^2 + TK^2$ $(a-15)^2+(b-6)^2 = 145+145$ $(a-15)^2+(12a-29-6)^2 = 290$ $(a-15)^2+(12a-35)^2 = 290$ $a^2-30a+225+144a^2-840a+1225 = 290$ $145a^2-870a+1160 = 0$ $a^2-6a+8 = 0$ $\therefore (a-2)(a-4) = 0$ $a = 2$ or $a = 4$ $\therefore b = 12(2) - 29$ or $b = 12(4) - 29$ $= -5$ $= 19$ $K(2 ; -5)$	✓ substitution into distance formula ✓ substitution of $b = 12a - 29$ ✓ $(a-3)^2 = 1$ ✓ ± 1 ✓ values of a ✓ value of b (6) ✓ substitution ✓ substitution of $b = 12a - 29$ ✓standard form ✓ factors ✓ values of a ✓ value of b (6)
		[23]

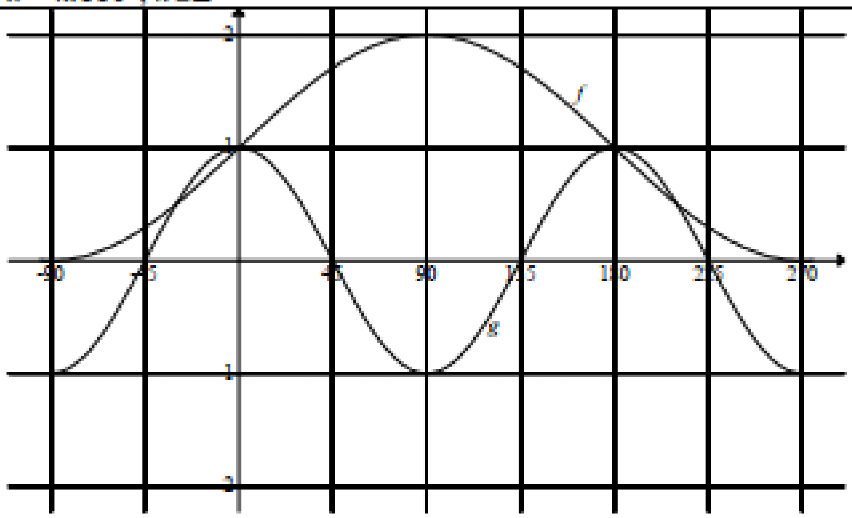
Question 5 **November 2014**

5.1	$\sin C\hat{A}P = \frac{CP}{AP}$ $\sin x = \frac{4\sqrt{3}}{8} = \frac{\sqrt{3}}{2}$ $x = 60°$ OR/OF $\frac{\sin 90°}{8} = \frac{\sin x}{4\sqrt{3}}$ $\sin x = \frac{4\sqrt{3}}{8} = \frac{\sqrt{3}}{2}$ $x = 60°$	✓ correct sine ratio/ *korrekte sin-verh* ✓ $\frac{\sqrt{3}}{2}$ (2) ✓ correct sine ratio/ *korrekte sin-verh* ✓ $\frac{\sqrt{3}}{2}$ (2)
5.2	$C\hat{P}A = D\hat{P}A = 30°$ (AP bisects $D\hat{P}C$) $AD^2 = AP^2 + DP^2 - 2.AP.DP.\cos A\hat{P}D$ $= 8^2 + 4^2 - 2(8)(4)\cos 30°$ $= 8^2 + 4^2 - 2(8)(4)(\frac{\sqrt{3}}{2})$ $= 24,57...$ $AD = 4,96$	✓ $D\hat{P}A = 30°$ ✓ correct subst into cosine rule/ *korrekte subst in cos-reël* ✓ 24,57... ✓ 4,96 (4)
5.3	$\frac{\sin D\hat{A}P}{DP} = \frac{\sin A\hat{P}D}{AD}$ $\frac{\sin y}{4} = \frac{\sin 30°}{4,96}$ $\sin y = \frac{4\sin 30°}{4,96}$ $= 0,403...$ $y = 23,78°$ **OR/*OF*** $AD^2 = AP^2 + DP^2 - 2.AP.DP.\cos D\hat{A}P$ $4^2 = 8^2 + (4,96)^2 - 2(8)(4,96).\cos y$ $\cos y = \frac{8^2 + (4,96)^2 - 4^2}{2(8)(4,96)}$ $\cos y = 0,9148...$ $y = 23,82°$	✓ correct subst into sine rule/ *korrekte subst in sin-reël* ✓ $\sin y$ subject ✓ 23,78° (3) ✓ correct subst into cosine rule/ *korrekte subst in cos-reël* ✓ $\cos y$ subject ✓ 23,82° (3) **[9]**

Question 6 **November 2014**

6.1	$\cos^2(180° + x) + \tan(x - 180°)\sin(720° - x)\cos x$ $= (-\cos x)^2 + [-(-\tan x)](-\sin x)(\cos x)$ $= \cos^2 x + \left(\frac{\sin x}{\cos x}\right)(-\sin x)(\cos x)$ $= \cos^2 x - \sin^2 x$ $= \cos 2x$	✓ $(-\cos x)^2$ or $\cos^2 x$ ✓ $\tan x$ or $-(-\tan x)$ ✓ $-\sin x$ ✓ $\tan x = \frac{\sin x}{\cos x}$ ✓ $\cos^2 x - \sin^2 x$ (5)
6.2	$\sin(\alpha - \beta)$ $= \cos[90° - (\alpha - \beta)]$ $= \cos[(90° - \alpha) + \beta]$ $= \cos(90° - \alpha)\cos\beta - \sin(90° - \alpha)\sin\beta$ $= \sin\alpha\cos\beta - \cos\alpha\sin\beta$ **OR/*OF*** $\sin(\alpha - \beta)$ $= \cos[90° - (\alpha - \beta)]$ $= \cos[(90° + \beta) + (-\alpha)]$ $= \cos(90° + \beta)\cos(-\alpha) - \sin(90° + \beta)\sin(-\alpha)$ $= (-\sin\beta)\cos\alpha - \cos\beta(-\sin\alpha)$ $= \sin\alpha\cos\beta - \cos\alpha\sin\beta$	✓rewrite as/*herskryf* $\cos[(90° - \alpha) + \beta]$ ✓ expansion/ *uitbreiding* ✓simpl/*vereenv* (3) ✓ rewrite as/*herskryf* $\cos[(90° + \beta) + (-\alpha)]$ ✓ expansion/ *uitbreiding* ✓simpl/*vereenv* (3)
6.3	$x^2 - y^2$ $= \sin^2 76° - \cos^2 76°$ $= -(\cos^2 76° - \sin^2 76°)$ $= -\cos 2(76°)$ $= -\cos 152°$ $= -(-\cos 28°)$ **OR/*OF*** $= -\cos(90° + 62°)$ $= \cos 28°$ $= -(-\sin 62°)$ $= \cos(90° - 62°)$ $= \sin 62°$ $= \sin 62°$ **OR/*OF*** $x^2 - y^2$ $= \sin^2 76° - \cos^2 76°$ $= \sin 76° \sin 76° - \cos 76° \cos 76°$ $= \sin 76° \cos 14° - \cos 76° \sin 14°$ $= \sin(76° - 14°)$ $= \sin 62°$ **OR/*OF*** $x^2 - y^2$ $= \sin^2 76° - \cos^2 76°$ $= \cos^2 14° - \sin^2 14°$ $= \cos 2(14°)$ $= \cos 28°$ $= \sin 62°$	✓$-(\cos^2 76° - \sin^2 76°)$ ✓ recognition of cos double angle ✓ $-\cos 152°$ ✓ $\cos 28°$ (4) ✓ $\cos 14°$ ✓ $\sin 14°$ ✓ recognition of sine compound angle ✓ $\sin(76° - 14°)$ (4) ✓ $\cos^2 14°$ ✓ $\sin^2 14°$ ✓ recognition of cos double angle ✓ $\cos 28°$ (4) **[12]**

Question 7 **November 2014**

7.1	$0 \le y \le 2$ or $y \in [0\ ;\ 2]$	✓ critical values/ *kritieke waardes* ✓ notation/*notasie* (2)
7.2	$\sin x + 1 = \cos 2x$ $\sin x + 1 = 1 - 2\sin^2 x$ $2\sin^2 x + \sin x = 0$ $\sin x(2\sin x + 1) = 0$	✓ $1 - 2\sin^2 x$ ✓ st form/*st vorm* (2)
7.3	$\sin x(2\sin x + 1) = 0$ $\sin x = 0$ *or* $\sin x = -\frac{1}{2}$ $x = 0° + k.360°$ or $x = 210° + k.360°$ or $x = 180° + k.360°$ $x = 330° + k.360°, k \in Z$ **OR/*OF*** $x = k.180°, k \in Z$	✓ $\sin x = 0$ *or* $\sin x = -\frac{1}{2}$ ✓ $0°\ ;\ 180°$ **OR/*OF*** $x = k.180°$ ✓ $210°\ ;\ 330°$ ✓ $k.360°,\ k \in Z$ (4)
7.4		✓ y-intercept/*afsnit* ✓ x-intercepts/*afsnitte* ✓ min/max points/ *min/maks punte* (3)
7.5	$f(x) = g(x)$ at/*by*: $x = -30°\ ;\ 0°\ ;\ 180°\ ;\ 210°$ $\therefore f(x + 30°) = g(x + 30°)$ at/*by*: $x = -60°\ ;\ -30°\ ;\ 150°\ ;\ 180°$	✓ $-30°\ ;\ 0°\ ;\ 180°\ ;\ 210°$ ✓✓ $-60°\ ;\ -30°\ ;\ 150°\ ;\ 180°$ (3)
7.6	Series will converge if/*Reeks sal konvergeer as:* $-1 < r < 1$ $-1 < 2\cos 2x < 1$ $-\frac{1}{2} < \cos 2x < \frac{1}{2}$ $\therefore\ 30° < x < 60°$ or $x \in (30°\ ;\ 60°)$	✓ $-1 < r < 1$ ✓ $r = 2\cos 2x$ ✓ $-\frac{1}{2} < \cos 2x < \frac{1}{2}$ ✓✓ $30° < x < 60°$ (5) **[19]**

Question 5 **Feb March 2015**

5.1	x^2+y^2 $=(3\sin\theta)^2+(3\cos\theta)^2$ $=9\sin^2\theta+9\cos^2\theta$ $=9(\sin^2\theta+\cos^2\theta)$ $=9(1)$ $=9$	✓ simpl/*vereenv* ✓ CF/*GF* = 9 ✓ answer/*antw* (3)
5.2	$\sin(540°-x).\sin(-x)-\cos(180°-x).\sin(90°+x)$ $\sin(180°-x).\sin(-x)-\cos(180°-x).\sin(90°+x)$ $=(\sin x)(-\sin x)-(-\cos x)(\cos x)$ $=-\sin^2 x+\cos^2 x$ $=\cos 2x$	✓ $\sin(540°-x)=\sin x$ ✓ $\sin(-x)=-\sin x$ ✓ $\cos(180°-x)=-\cos x$ ✓ $\sin(90°+x)=\cos x$ ✓ $-\sin^2 x+\cos^2 x$ ✓ $\cos 2x$ (6)
5.3.1	$OT=\sqrt{x^2+p^2}$ $\sin\alpha=\frac{y_T}{OT}$ $=\frac{p}{\sqrt{x^2+p^2}}$ $\frac{p}{\sqrt{x^2+p^2}}=\frac{p}{\sqrt{1+p^2}}$ $x^2=1$ $x=-1$ **OR/OF** (P lies in 3rd quadrant) $x^2+y^2=r^2$ $x^2+p^2=\left(\sqrt{1+p^2}\right)^2$ $x^2+p^2=1+p^2$ $x^2=1$ $x=-1$ (P lies in 3rd quadrant)	✓ $OT=\sqrt{x^2+p^2}$ ✓ $\sin\alpha=\frac{y_T}{OT}$ ✓ $x^2=1$ (3) ✓ $x^2+y^2=r^2$ ✓ subst ✓ $x^2=1$ (3)
5.3.2	$\cos(180°+\alpha)$ $=-\cos\alpha$ $=-\left(\frac{-1}{\sqrt{1+p^2}}\right)$ $=\frac{1}{\sqrt{1+p^2}}$	✓ $-\cos\alpha$ ✓ answer/*antw* (2)

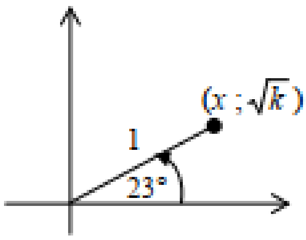
5.3.3	$\cos 2\alpha$ $= \cos^2\alpha - \sin^2\alpha$ $= \left(\frac{-1}{\sqrt{1+p^2}}\right)^2 - \left(\frac{p}{\sqrt{1+p^2}}\right)^2$ $= \frac{1}{1+p^2} - \frac{p^2}{1+p^2}$ $= \frac{1-p^2}{1+p^2}$	✓ expansion/ *uitbreiding* ✓✓ squaring each term/*kwadreer elke term* (3)
	OR/*OF*	
	$\cos 2\alpha$ $= 1 - 2\sin^2\alpha$ $= 1 - 2\left(\frac{p}{\sqrt{1+p^2}}\right)^2$ $= 1 - 2\left(\frac{p^2}{1+p^2}\right)$ $= 1 - \frac{2p^2}{1+p^2}$ $= \frac{1+p^2-2p^2}{1+p^2}$ $= \frac{1-p^2}{1+p^2}$	✓ expansion/ *uitbreiding* ✓squaring/*kwadrering* ✓ writing as single fraction/*skryf as enkelterm* (3)
	OR/*OF*	
	$\cos 2\alpha$ $= 2\cos^2\alpha - 1$ $= 2\left(\frac{-1}{\sqrt{1+p^2}}\right)^2 - 1$ $= 2\left(\frac{1}{1+p^2}\right) - 1$ $= \frac{2}{1+p^2} - 1$ $= \frac{2-1-p^2}{1+p^2}$ $= \frac{1-p^2}{1+p^2}$	✓ expansion/ *uitbreiding* ✓squaring/*kwadrering* ✓ writing as single fraction/*skryf as enkelterm* (3)

5.4.1	The identity is undefined for/*die identiteit is ongedefinieerd as:* $2\sin^2 x = 0$ $\therefore$ $\underline{\sin x = 0:}$ $x = 0°$; $180°$ or/*of* $\underline{\tan x = \infty:}$ $x = 90°$ $\therefore$ $x = 0°$; $90°$; $180°$	✓ $x = 0°$ ✓ $x = 90°$ ✓ $x = 180°$ (3)
5.4.2	LHS/LK $= \dfrac{2\tan x - \sin 2x}{2\sin^2 x}$ $= \dfrac{2\left(\dfrac{\sin x}{\cos x}\right) - 2\sin x\cos x}{2\sin^2 x}$ $= \left(\dfrac{2\sin x - 2\sin x\cos^2 x}{\cos x}\right) \times \dfrac{1}{2\sin^2 x}$ $= \dfrac{2\sin x(1-\cos^2 x)}{\cos x} \times \dfrac{1}{2\sin^2 x}$ $= \dfrac{2\sin x(\sin^2 x)}{\cos x} \times \dfrac{1}{2\sin^2 x}$ $= \dfrac{\sin x}{\cos x}$ $= \tan x$ = RHS/RK	✓ $\dfrac{\sin x}{\cos x}$ ✓ $2\sin x.\cos x$ ✓ simplify numerator/ *vereenv teller* ✓ factorising/*fakt* ✓ $1 - \cos^2 x = \sin^2 x$ ✓ simplify to/*vereenv na* $\dfrac{\sin x}{\cos x}$ (6)
	OR/*OF* LHS/LK $= \dfrac{2\tan x - \sin 2x}{2\sin^2 x}$ $= \dfrac{2\left(\dfrac{\sin x}{\cos x}\right) - 2\sin x\cos x}{2\sin^2 x} \times \dfrac{\cos x}{\cos x}$ $= \dfrac{2\sin x - 2\sin x\cos^2 x}{2\sin^2 x\cos x}$ $= \dfrac{2\sin x(1-\cos^2 x)}{2\sin^2 x\cos x}$ $= \dfrac{2\sin x.\sin^2 x}{2\sin^2 x\cos x}$ $= \dfrac{\sin x}{\cos x}$ $= \tan x$ = RHS/RK	✓ $\dfrac{\sin x}{\cos x}$ ✓ $2\sin x.\cos x$ ✓ simpl/*vereenv* ✓ factorising/*fakt* ✓ $1 - \cos^2 x = \sin^2 x$ ✓ simplify to /*vereenv na* $\dfrac{\sin x}{\cos x}$ (6) **[26]**

Question 6 **Feb March 2015**

6.1.1	In ΔTAK: $\frac{AK}{KT} = \sin K\hat{T}A$ $AK = KT.\sin x$ $= 2\sin x$ **OR/*OF*** $\frac{\sin K\hat{T}A}{AK} = \frac{\sin K\hat{A}T}{KT}$ $\frac{\sin x}{AK} = \frac{\sin 90°}{2}$ $AK = 2\sin x$	✓ correct trig ratio/ *korrekte trigverh.* ✓answer/*antw* (2) ✓ correct subst into sine rule/*korrekte subst in sin-reël* ✓answer/*antw* (2)
6.1.2	In ΔAKF: $\frac{KF}{\sin K\hat{A}F} = \frac{AK}{\sin A\hat{F}K}$ $\frac{KF}{\sin(90° + x)} = \frac{AK}{\sin 2x}$ $KF = \frac{AK.\sin(90° + x)}{\sin 2x}$ $= \frac{2\sin x.\cos x}{2\sin x.\cos x}$ $= 1$ **OR/*OF*** In ΔAKF: $\frac{KF}{\sin K\hat{A}F} = \frac{AK}{\sin A\hat{F}K}$ $\frac{KF}{\sin(90° + x)} = \frac{AK}{\sin 2x}$ $KF = \frac{AK.\sin(90° + x)}{\sin 2x}$ $= \frac{AT.\tan x.\cos x}{2\sin x.\cos x}$ $= \frac{2\cos x.\frac{\sin x}{\cos x}.\cos x}{2\sin x.\cos x}$ $= 1$ $\cos x = \frac{AT}{2}$ $\therefore AT = 2\cos x$	✓ using sine rule/ *gebruik sin-reël* ✓ correct subst into sine rule/*korrekte subst in sin-reël* ✓ $\sin(90° + x) = \cos x$ ✓ $2\sin x.\cos x$ ✓ 1 (5) ✓ using sine rule/ *gebruik sin-reël* ✓ correct subst into sine rule/*korrekte subst in sin-reël* ✓ $\sin(90° + x) = \cos x$ ✓ $2\sin x.\cos x$ ✓ 1 (5)

Question 5 **November 2015**

5.1.1	$\sin 203°$ $= -\sin 23°$ $= -\sqrt{k}$	✓ reduction/ *reduksie* ✓ answ ito/*antw itv k* (2)
5.1.2	$\cos^2 23° = 1 - \sin^2 23°$ $= 1 - k$ $\cos 23° = \sqrt{1-k}$	✓identity/*identiteit* ✓ $\cos^2 23°$ ito/*itv k* ✓ answ/*antw* (3)
	OR/*OF*	
	$x^2 + (\sqrt{k})^2 = 1$ $x^2 = 1 - k$ $x = \sqrt{1-k}$ $\cos 23° = \dfrac{\sqrt{1-k}}{1} = \sqrt{1-k}$  	✓ $x^2 = 1 - k$ ✓ x ito/*itv k* ✓ answ/*antw* (3)
5.1.3	$\tan(-23°) = -\tan 23°$ $= -\dfrac{\sin 23°}{\cos 23°}$ $= -\dfrac{\sqrt{k}}{\sqrt{1-k}} = -\sqrt{\dfrac{k}{1-k}}$	✓ reduction/ *reduksie* ✓ answ ito/*antw itv k* (2)
	OR/*OF*	
	$\tan(-23°) = -\tan 23°$ $= -\dfrac{\sqrt{k}}{\sqrt{1-k}} = -\sqrt{\dfrac{k}{1-k}}$	✓ reduction/ *reduksie* ✓ answ ito/*antw itv k* (2)
5.2	$\dfrac{4\cos x.(-\sin x)}{\sin(30° - x + x)}$ $= \dfrac{-4\sin x.\cos x}{\sin 30°}$ $= \dfrac{-4\sin x.\cos x}{\frac{1}{2}}$ $= -8\sin x.\cos x$ $= -4(2\sin x.\cos x)$ $= -4\sin 2x$	✓ $\cos x$ ✓ $-\sin x$ ✓ $\sin(\alpha + \beta)$ ✓ $\frac{1}{2}$ ✓ double sine form / *dubbel sin form* ✓ answ/*antw* (6)

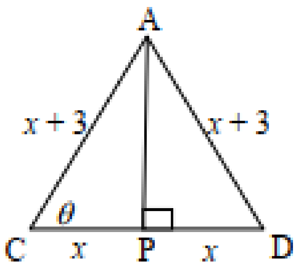
	OR/OF $\frac{4\cos x.(-\sin x)}{(\sin 30^\circ\cos x-\cos 30^\circ\sin x)\cos x+(\cos 30^\circ\cos x+\sin 30^\circ\sin x)\sin x}$ $=\frac{-4\sin x.\cos x}{(\frac{1}{2}\cos x-\frac{\sqrt{3}}{2}\sin x)\cos x+(\frac{\sqrt{3}}{2}\cos x+\frac{1}{2}\sin x)\sin x}$ $=\frac{-2(2\sin x.\cos x)}{\frac{1}{2}\cos^2 x+\frac{1}{2}\sin^2 x}$ $=\frac{-2(2\sin x.\cos x)}{\frac{1}{2}(\cos^2 x+\sin^2 x)}$ $=\frac{-2(2\sin x.\cos x)}{\frac{1}{2}(1)}$ $=-8\cos x\sin x$ $=-4(2\sin x\cos x)$ $=-4\sin 2x$	✓ $\cos x$ ✓ $-\sin x$ ✓ $\frac{1}{2}\cos^2 x+\frac{1}{2}\sin^2 x$ ✓ $\frac{1}{2}$ ✓ double sine form / *dubbel sin form* ✓ answ/*antw* (6)
5.3	$\cos 2x-7\cos x-3=0$ $2\cos^2 x-1-7\cos x-3=0$ $2\cos^2 x-7\cos x-4=0$ $(2\cos x+1)(\cos x-4)=0$ $\therefore\ \cos x=-\frac{1}{2}$ or/*of* $\cos x=4$ (no solution) $\therefore\ x=120^\circ+n.360^\circ$ or/*of* $x=240^\circ+n.360^\circ$; $n\in Z$ **OR/OF** $\therefore\ x=\pm 120^\circ+n.360^\circ$; $n\in Z$	✓ expansion/ *uitbreiding* ✓ $2\cos^2 x-7\cos x-4=0$ ✓ factors/*faktore* ✓ $\cos x=-\frac{1}{2}$ ✓ 120° & 240° ✓ $+n.360^\circ$ **OR/OF** ✓ $\pm 120^\circ$ ✓ $+n.360^\circ$ (6)
5.4	$\sin 3\theta=\sin(2\theta+\theta)$ $=\sin 2\theta\cos\theta+\cos 2\theta\sin\theta$ $=2\sin\theta\cos\theta\cos\theta+(1-2\sin^2\theta)\sin\theta$ $=2\sin\theta(1-\sin^2\theta)+\sin\theta-2\sin^3\theta$ $=3\sin\theta-4\sin^3\theta$ $=3(\frac{1}{3})-4(\frac{1}{3})^3$ $=1-\frac{4}{27}$ $=\frac{23}{27}$	✓ expansion of/ *uitbreiding van* $\sin(2\theta+\theta)$ ✓ expansions of $\sin 2\theta$ AND $\cos 2\theta$ ✓ $1-\sin^2\theta$ ✓ subst ✓ answ/*antw* (5) **[24]**

Question 6 **November 2015**

6.1	$f(x)=\cos x-\frac{1}{2}$ and/*en* $g(x)=\sin(x+30°)$ $\therefore p=30°$ and/*en* $q=-\frac{1}{2}$ **OR/*OF*** $\sin(60°+p)=1$ and/*en* $\cos 0° + q=\frac{1}{2}$ $\therefore p=30°$ $\therefore q=-\frac{1}{2}$	✓ $f(x)=\cos x-\frac{1}{2}$ ✓ $g(x)=\sin(x+30°)$ ✓ value of/*waarde v* p ✓ value of/*waarde v* q (4) ✓ $\sin(60°+p)=1$ ✓ $\cos 0° + q=\frac{1}{2}$ ✓ value of/*waarde v* p ✓ value of/*waarde v* q (4)
6.2	$x\in(-120°\,;\,0°)$ **OR/*OF*** $-120°<x<0°$	✓ critical values/ *kritiese waardes* ✓ correct interval/ *korrekte interval* (2)
6.3	The graph of g has to shift 60° to the left and then be reflected about the x-axis./*Die grafiek van g moet 60° na links skuif en dan om die x-as gereflekteer word.* **OR/*OF*** The graph of g must be reflected about the x-axis and then be shifted 60° to the left./*Die grafiek van g moet om die x-as gereflekteer word en dan met 60° na links geskuif word.* **OR/*OF*** The graph of g has to shift 120° to the right./*Die grafiek van g moet 120° na regs geskuif word.* **OR/*OF*** The graph of g has to shift 240° to the left./*Die grafiek van g moet met 240° na links geskuif word*	✓ 60° left/*links* ✓ reflection about x-axis/*refleksie om x-as* (2) ✓ reflection about x-axis/*refleksie om x-as* ✓ 60° left/*links* (2) ✓ ✓ 120° right/*regs* (2) ✓ ✓ 240° left/*links* (2) **[8]**

Question 7 **November 2015**

7.1	$C\hat{A}D=180°-2\theta$ [∠s sum of Δ/*∠e som van Δ*]	✓ answ/*antw* (1)

7.2	$\frac{\sin\theta}{x+3}=\frac{\sin(180°-2\theta)}{2x}$ $\frac{\sin\theta}{x+3}=\frac{\sin 2\theta}{2x}$ $\frac{\sin\theta}{x+3}=\frac{2\sin\theta.\cos\theta}{2x}$ $\cos\theta=\frac{2x\sin\theta}{2(x+3)\sin\theta}$ $\cos\theta=\frac{x}{x+3}$	✓ correct subst into sine rule/*korrekte subst in sin-reël* ✓ $\sin 2\theta$ ✓ $2\sin\theta.\cos\theta$ ✓ $\cos\theta$ as subject/ *as onderwerp* (4)
	OR/*OF* $AD = x+3$ [sides opp = ∠s/*sye to* = ∠*e*] $AC^2 = AD^2 + CD^2 - 2AD.CD.\cos\theta$ $(x+3)^2=(x+3)^2+(2x)^2-2(2x)(x+3).\cos\theta$ $0=4x^2-4x(x+3)\cos\theta$ $\cos\theta=\frac{4x^2}{4x(x+3)}$ $=\frac{x}{x+3}$	✓ $AD = x+3$ ✓ correct subst into cosine rule/*korrekte subst in cos-reël* ✓ simplification/ *vereenvoudiging* ✓ $\cos\theta$ as subject/ *as onderwerp* (4)
	OR/*OF* Draw/*Trek* AP ⊥ CD $\cos\theta=\frac{x}{x+3}$ 	✓ ✓ constr/*konstr* ✓ ✓ sketch shown/ *toon skets* (4)
7.3	$\cos\theta=\frac{2}{5}$ $\therefore\ \theta=66{,}42°$ In ΔABC: $\sin\frac{1}{2}\theta=\frac{AB}{AC}$ $\sin 33{,}21°=\frac{AB}{5}$ $\therefore\ AB=5\sin 33{,}21°$ $=2{,}74$	✓ $\cos\theta=\frac{2}{5}$ ✓ size of/*grootte v* θ ✓ correct ratio/ *korrekte verh* ✓ subst correctly/ *korrek* ✓ answ/*antw* (5)
	OR/*OF* $\sin\frac{\theta}{2}=\frac{AB}{5}$ $\therefore AB=5\sin\frac{\theta}{2}$	✓ $AB=5\sin\frac{\theta}{2}$

	but/*maar*: $\cos\theta = \frac{2}{5}$ $1-2\sin^2\frac{\theta}{2} = \frac{2}{5}$ $\sin^2\frac{\theta}{2} = \frac{3}{10}$ $\sin\frac{\theta}{2} = \sqrt{\frac{3}{10}}$ $\therefore \text{AB} = 5\sqrt{\frac{3}{10}} = \sqrt{\frac{15}{2}} = 2{,}74$	✓ equation/*vgl* ✓ simplification/ *vereenvoudiging* ✓ value of/*waarde v* $\sin\frac{\theta}{2}$ ✓ answ/*antw* (5) **[10]**

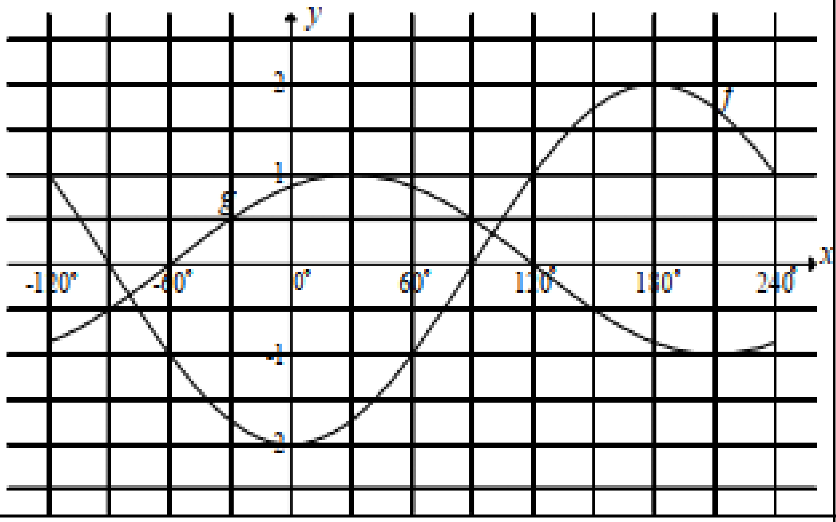
Question 5 **Feb March 2016**

5.1.1	$\tan\theta = -\frac{3}{\sqrt{7}}$	✓answ/*antw* (1)
5.1.2	$\sin(-\theta) = -\sin\theta$ $\text{OP}^2 = \left(-\sqrt{7}\right)^2 + 3^2$ $\text{OP}^2 = 16$ $\text{OP} = 4$ $\sin(-\theta) = -\frac{3}{4}$	✓reduction/ *reduksie* ✓ $\text{OP} = 4$ ✓answ/*antw* (3)
5.1.3	$\frac{a}{6} = \cos 2\theta$ $a = 6(1-2\sin^2\theta)$ $= 6-12\left(\frac{3}{4}\right)^2$ $= \frac{24}{4} - \frac{27}{4}$ $= -\frac{3}{4}$ **OR/*OF*** $\frac{a}{6} = \cos 2\theta$ $a = 6(2\cos^2\theta - 1)$ $= 12\left(\frac{-\sqrt{7}}{4}\right)^2 - 6$ $= \frac{21}{4} - \frac{24}{4}$ $= -\frac{3}{4}$ **OR/*OF***	✓trig ratio/*verh* ✓expansion/ *uitbreiding* ✓ $\sin\theta = \frac{3}{4}$ ✓answ/*antw* (4) ✓trig ratio/*verh* ✓expansion/ *uitbreiding* ✓ $\cos\theta = \frac{-\sqrt{7}}{4}$ ✓answ/*antw* (4)

	$\frac{a}{6}=\cos 2\theta$ $a=6(\cos^2\theta-\sin^2\theta)$ $=6\left[\left(\frac{-\sqrt{7}}{4}\right)^2-\left(\frac{3}{4}\right)^2\right]$ $=6\left(-\frac{2}{16}\right)$ $=-\frac{3}{4}$	✓ trig ratio/*verh* ✓expansion/ *uitbreiding* ✓ $\cos\theta=\frac{-\sqrt{7}}{4}$ & $\sin\theta=\frac{3}{4}$ ✓answ/*antw* (4)
5.2.1	$\frac{4\sin x.\cos x}{2\sin^2 x-1}=\frac{2(2\sin x.\cos x)}{-(1-2\sin^2 x)}$ $=\frac{2\sin 2x}{-\cos 2x}$ $=-2\tan 2x$	✓2sin 2x ✓−cos 2x ✓answ/*antw* (3)
5.2.2	$\frac{4\sin 15°\cos 15°}{2\sin^2 15°-1}=-2\tan 2(15°)$ $=-2\tan 30°$ $=-2\left(\frac{1}{\sqrt{3}}\right)$ $=-\frac{2}{\sqrt{3}}$ **OR/*OF*** $-\frac{2\sqrt{3}}{3}$	✓ $-2\tan 2(15°)$ ✓answ/*antw* (2) **[13]**

Question 6 **Feb March 2016**

6.1	$\sin(x+60°)+2\cos x=0$ $\sin x\cos 60°+\cos x\sin 60°+2\cos x=0$ $\frac{1}{2}\sin x+\frac{\sqrt{3}}{2}\cos x+2\cos x=0$ $\frac{1}{2}\sin x=-2\cos x-\frac{\sqrt{3}}{2}\cos x$ $\sin x=-4\cos x-\sqrt{3}\cos x$ $\sin x=\cos x(-4-\sqrt{3})$ $\frac{\sin x}{\cos x}=\frac{\cos x(-4-\sqrt{3})}{\cos x}$ $\therefore\tan x=-4-\sqrt{3}$	✓expansion/*uitbreiding* ✓special angle values/ *spesiale ∠-waardes* ✓simpl/*vereenv* ✓ $\sin x=\cos x(-4-\sqrt{3})$ (4)

6.2	$\tan x = -4-\sqrt{3}$ $\tan x = -(4+\sqrt{3})$ *ref* $\angle = 80{,}10°$ $x = -80{,}1°$ or/*of* $99{,}9°$	✓80,10° ✓99,90° ✓–80,1° (3)
6.3.1		✓(30° ; 1) ✓(–60° ; 0) ✓shape/*vorm* (3)
6.3.2	$\therefore \sin(x+60°) > -2\cos x$ $x \in (-80{,}10° ; 99{,}90°)$ **OR/*OF*** $-80{,}10° < x < 99{,}90°$	✓✓critical values/ *kritiese waardes* ✓notation/*notasie* (3) **[13]**

Question 7 **Feb March 2016**

7.1.1	Area of/*Oppervlakte van* $\Delta PQR = \frac{1}{2}PQ.QR.\sin\hat{Q}$ $= \frac{1}{2}x(20-4x)(\sin 60°)$ $= 10x - 2x^2\left(\frac{\sqrt{3}}{2}\right)$ $= 5\sqrt{3}x - \sqrt{3}x^2$	✓subst into area rule/ *subst in opp-reël* ✓subst & simpl/ *subst en vereenv* (2)
7.1.2	For maximum area/*Vir maksimum opp*: $(\text{Area } \Delta PQR)' = 0$ $5\sqrt{3} - 2\sqrt{3}x = 0$ $2\sqrt{3}x = 5\sqrt{3}$ $\therefore x_{max} = \frac{5}{2}$ or $2\frac{1}{2}$ or/*of* 2,5 **OR/*OF*** $x_{max} = -\frac{b}{2a}$ $= -\frac{5\sqrt{3}}{2(-\sqrt{3})} = \frac{5}{2}$ or $2\frac{1}{2}$ or 2,5	✓$(\text{Area } \Delta PQR)' = 0$ ✓$5\sqrt{3} - 2\sqrt{3}x$ ✓answ/*antw* (3) ✓formula/*e* ✓ subst ✓answ/*antw* (3)

	OR/*OF* $5\sqrt{3}x-\sqrt{3}x^2=0$ $\sqrt{3}x(5-x)=0$ $\therefore x=0$ or 5 $\therefore x_{max}=\frac{0+5}{2}=\frac{5}{2}$ or/*of* 2,5	✓x-intercepts/ *x-afsnitte* ✓subst ✓answ/*antw* (3)
7.1.3	$RP^2=QP^2+QR^2-2.QP.QR.\cos Q$ $=10^2+2{,}5^2-2(10)(2{,}5)\cos 60°$ $=81{,}25$ $\therefore RP=9{,}01$	✓subst into cosine rule/*in cos-reël* ✓simpl/*vereenv* ✓answ/*antw* (3)
7.2	In ΔABC: $\sin\beta=\frac{h}{AB}$ $\therefore AB=\frac{h}{\sin\beta}$ In ΔABD: $AB=BD$ and/*en* $A\hat{D}B=90°-\beta$ [$\angle$s of/*v* $\Delta=180°$] $\frac{\sin 2\beta}{AD}=\frac{\sin(90°-\beta)}{AB}$ $AD=\frac{AB.\sin 2\beta}{\sin(90°-\beta)}$ $=\frac{h}{\sin\beta}\times\frac{2\sin\beta.\cos\beta}{\cos\beta}$ $=2h$	✓AB ito h and/*en* β ✓ $A\hat{D}B=90°-\beta$ ✓correct subst into cosine rule/*subst korrek in cos-reël* ✓AD as subject/ *onderwerp* ✓expansion/*uitbrei* ✓sin $(90°-\beta)$ $=\cos\beta$ ✓answer ito h (7)
	OR/*OF* In ΔABC: $\sin\beta=\frac{h}{AB}$ $\therefore AB=\frac{h}{\sin\beta}$ In ΔABD: $AB=BD$ $AD^2=AB^2+AB^2-2AB.AB.\cos 2\beta$ $=\left(\frac{h}{\sin\beta}\right)^2+\left(\frac{h}{\sin\beta}\right)^2-2\left(\frac{h}{\sin\beta}\right)^2.\cos 2\beta$ $=\left(\frac{h}{\sin\beta}\right)^2+\left(\frac{h}{\sin\beta}\right)^2-2\left(\frac{h}{\sin\beta}\right)^2(1-2\sin^2\beta)$ $=\left(\frac{h}{\sin\beta}\right)^2+\left(\frac{h}{\sin\beta}\right)^2-2\left(\frac{h}{\sin\beta}\right)^2+4h^2$ $=4h^2$ $\therefore AD=2h$	✓AB ito h and/*en* β ✓correct subst into cosine rule/*subst korrek in cos-reël* ✓expansion/*uitbrei* ✓multiplication/ *vermenigv* ✓simpl/*vereenv* ✓answer ito h

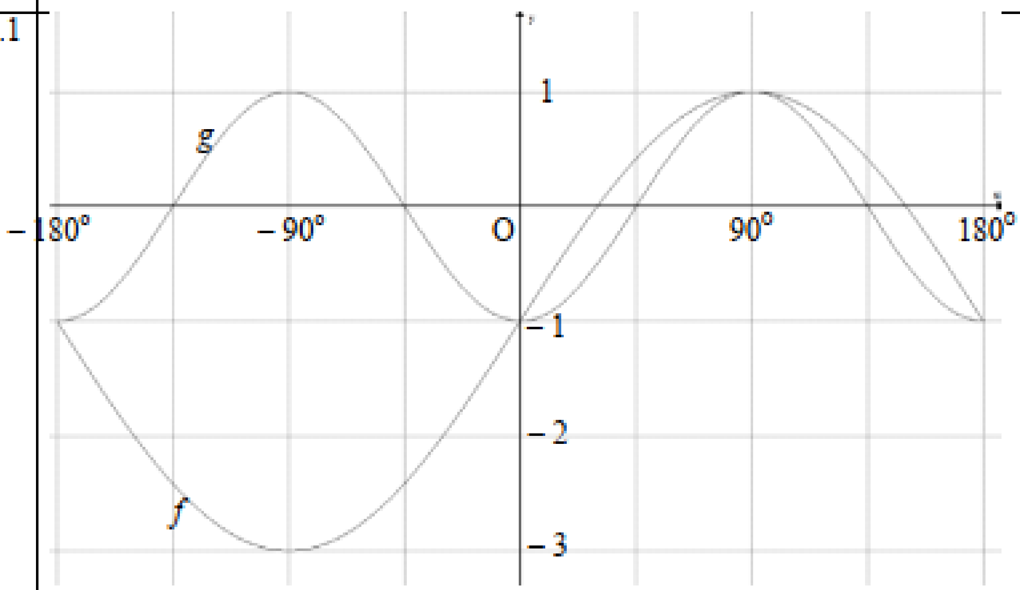
	OR/*OF* Split isosceles triangle ABQ into two congruent triangles AEB and DEB. Then $\Delta ABC \equiv \Delta BAE$ (AB = AC, $A\hat{B}E = B\hat{A}C = \beta$, h) $\therefore$ AE = ED = BC = h $\therefore$ AD = $2h$	(7)
		[15]

Question 5 **May June 2016**

5.1.1(a)	$\sin T = \frac{1}{\sqrt{5}} = \frac{\sqrt{5}}{5} = 0{,}45$	✓value (1)
5.1.1(b)	$\cos S = \frac{3}{\sqrt{10}} = \frac{3\sqrt{10}}{10} = 0{,}95$	✓value (1)
5.1.2	$\cos(T+S) = \cos T\cos S - \sin T\sin S$ $= \left(\frac{2}{\sqrt{5}}\right)\left(\frac{3}{\sqrt{10}}\right) - \left(\frac{1}{\sqrt{5}}\right)\left(\frac{1}{\sqrt{10}}\right)$ $= \frac{6}{\sqrt{50}} - \frac{1}{\sqrt{50}}$ $= \frac{5}{\sqrt{50}}$ *or* $\frac{1}{\sqrt{2}}$ *or* $\frac{\sqrt{2}}{2}$	✓expansion ✓ $\frac{2}{\sqrt{5}}$ ✓ $\frac{1}{\sqrt{10}}$ ✓ simplification ✓ answer (5)
5.2	$\frac{1}{\cos(360°-\theta)\sin(90°-\theta)} - \tan^2(180°+\theta)$ $= \frac{1}{(\cos\theta)(\cos\theta)} - \tan^2\theta$ $= \frac{1}{\cos^2\theta} - \left(\frac{\sin^2\theta}{\cos^2\theta}\right)$ $= \frac{1-\sin^2\theta}{\cos^2\theta}$ $= \frac{\cos^2\theta}{\cos^2\theta}$ *OR* $\frac{1-\sin^2\theta}{1-\sin^2\theta}$ $= 1$	✓ $\cos\theta$ ✓ $\cos\theta$ ✓ $\tan^2\theta$ ✓ $\frac{\sin^2\theta}{\cos^2\theta}$ ✓identity ✓ answer (6)

5.3	$(\sin x - \cos x)^2 = \left(\frac{3}{4}\right)^2$ $\sin^2 x - 2\sin x\cos x + \cos^2 x = \frac{9}{16}$ $1 - 2\sin x\cos x = \frac{9}{16}$ $2\sin x\cos x = \frac{7}{16}$ $\therefore \sin 2x = \frac{7}{16}$	✓ squaring both sides ✓expanding LHS ✓ using identity ✓ simplifying ✓answer (5) **[18]**

Question 6 **May June 2016**

6.1	$4\sin x + 2\cos 2x = 2$ $2\sin x + \cos 2x - 1 = 0$ $2\sin x + (1 - 2\sin^2 x) - 1 = 0$ $2\sin^2 x - 2\sin x = 0$ $2\sin x(\sin x - 1) = 0$ $2\sin x = 0$ or $\sin x - 1 = 0$ $\sin x = 0$ $\sin x = 1$ $x = k.180°$ or $x = 90° + k.360,\ k \in Z$	✓using identity ✓ standard form ✓ factors ✓ $\sin x = 0$ or $\sin x = 1$ ✓ $k.180°$ ✓ $90° + k.360,\ k \in Z$ (6)
6.2.1		✓ turning point (–90° ; –3) ✓ turning point (90° ; 1) ✓ (–180° ; –1) & (0° ; –1) (3)

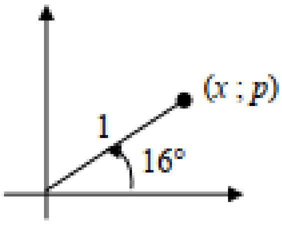
6.2.2	$(-90°;0°)$ **OR/*OF*** $-90° < x < 0°$	✓ ✓ answer (2) ✓ ✓ answer (2)
6.2.3	$f(x) = g(x)$ $\therefore -180°; 0°; 90°; 180°$ $f(x+30°) = g(x+30°)$ $\therefore x = -30°; 60°; 150°$	✓ any ONE correct ✓ other 2 correct (2) **[13]**

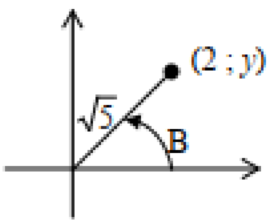
Question 7 **May June 2016**

7.1	$A\hat{B}D = \theta$ [alternate ∠s; ‖ lines] $\cos\theta = \frac{BD}{AB} = \frac{64}{81}$ $\theta = 38°$ OR/*OF* $\sin B\hat{A}D = \frac{64}{81}$ $B\hat{A}D = 52{,}18°$ $\theta = 38°$	✓correct trig ratio ✓substitution into correct ratio ✓ answer (to the nearest degree) (3) ✓correct trig ratio ✓substitution into correct ratio ✓ answer (to the nearest degree) (3)
7.2	$BC^2 = AB^2 + AC^2 - 2(AB)(AC)\cos B\hat{A}C$ $= 81^2 + 87^2 - 2(81)(87)\cos 82{,}6°$ $= 12314{,}754...$ $BC = 110{,}97\text{ m}$	✓use cosine rule ✓correct substitution into cosine rule ✓answer (3)

7.3	$\frac{\sin D\hat{C}B}{BD} = \frac{\sin B\hat{D}C}{BC}$ $\sin D\hat{C}B = \frac{BD.\sin B\hat{D}C}{BC}$ $\sin D\hat{C}B = \frac{64.\sin 110°}{110{,}97}$ $\therefore D\hat{C}B = 32{,}82°$	✓ use sine rule ✓ substitution ✓ answer (3) **[9]**

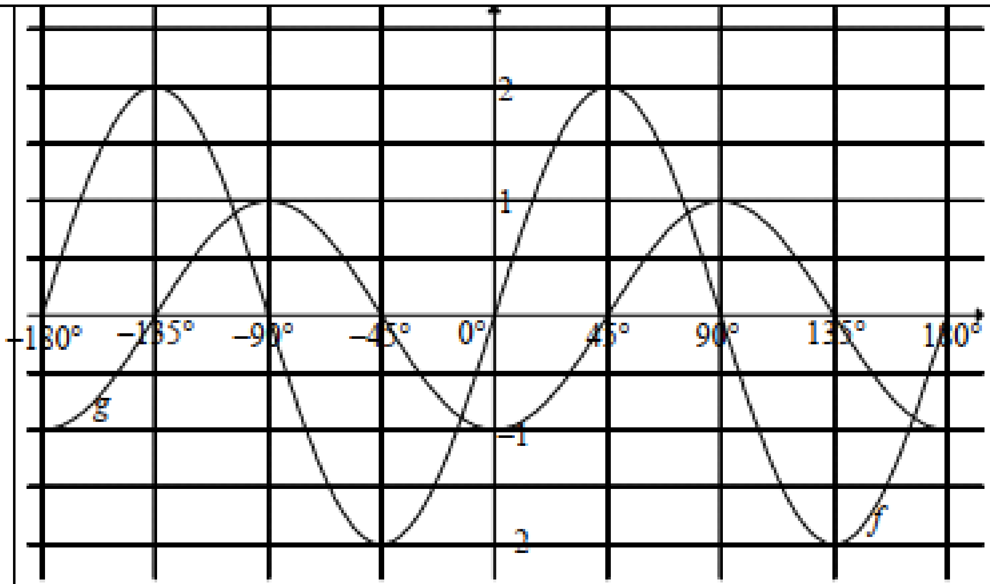
Question 5 **November 2016**

5.1.1	$\sin 196° = -\sin 16°$ $= -p$	✓reduction ✓answer (2)
5.1.2	$\cos 16° = \sqrt{1-\sin^2 16°}$ $= \sqrt{1-p^2}$ **OR/*OF***  $x^2 + p^2 = 1$ $x = \sqrt{1-p^2}$ $\therefore \cos 16° = \frac{\sqrt{1-p^2}}{1} = \sqrt{1-p^2}$	✓statement ✓answer (2) ✓x in terms of p ✓answer (2)
5.2	$\sin(A+B) = \cos[90° - (A+B)]$ $= \cos[(90° - A) - B]$ $= \cos(90° - A)\cos B + \sin(90° - A)\sin B$ $= \sin A\cos B + \cos A\sin B$	✓co-ratio ✓correct form ✓expansion (3)
5.3	$\frac{\sqrt{1-\cos^2 2A}}{\cos(-A).\cos(90°+A)}$ $= \frac{\sqrt{\sin^2 2A}}{\cos A.(-\sin A)}$ $= \frac{\sin 2A}{\cos A.(-\sin A)}$ $= \frac{2\sin A\cos A}{\cos A.(-\sin A)}$ $= -2$ **OR/OF** $\frac{\sqrt{1-\cos^2 2A}}{\cos(-A)\cos(90°+A)} = \frac{\sqrt{1-(2\cos^2 A-1)^2}}{\cos A.-\sin A}$ $= \frac{\sqrt{1-(4\cos^4 A-4\cos^2 A+1)}}{\cos A.-\sin A} = \frac{\sqrt{4\cos^2 A-4\cos^4 A}}{\cos A.-\sin A}$ $= \frac{\sqrt{4\cos^2 A(1-\cos^2 A)}}{\cos A.-\sin A} = \frac{\sqrt{4\cos^2 A\sin^2 A}}{\cos A.-\sin A}$ $= \frac{2\cos A.\sin A}{\cos A.-\sin A}$ $= -2$ **OR/OF**	✓$\sqrt{\sin^2 2A}$ ✓$\cos A$ ✓$-\sin A$ ✓$2\sin A\cos A$ ✓answer (5) ✓$2\cos^2 A - 1$ ✓$\cos A$ ✓$-\sin A$ ✓identity ✓answer (5)

	$\frac{\sqrt{1-(1-2\sin^2A)^2}}{\cos A.-\sin A}$ $=\frac{\sqrt{1-(1-4\sin^2A+4\sin^2A)}}{\cos A.-\sin A}$ $=\frac{\sqrt{4\sin^2A(1-\sin^2A)}}{\cos A.-\sin A}$ $=\frac{2\sin A\sqrt{\cos^2A}}{\cos A.-\sin A}$ $=-2$	✓$1-2\sin^2 A$ ✓$\cos A$ ✓$-\sin A$ ✓identity ✓ answer (5)
5.4.1	$\cos 2B=\frac{3}{5}$ $2\cos^2B-1=\frac{3}{5}$ $\cos^2B=\frac{4}{5}$ $\therefore \cos B=\sqrt{\frac{4}{5}}$ *or* $\frac{2}{\sqrt{5}}$ *or* $\frac{2\sqrt{5}}{5}$ $[0° \leq B \leq 90°]$ **OR/*OF*** $\cos B=\frac{\sqrt{\cos 2B+1}}{2}$ $=\frac{\sqrt{\frac{3}{5}+1}}{2}$ $=\frac{2\sqrt{5}}{5}$	✓ identity ✓ value of $\cos^2B$ ✓ answer (3) ✓ $=\frac{\sqrt{\cos 2B+1}}{2}$ ✓ value of $\cos^2B$ ✓ answer (3)
5.4.2	$\sin^2B=1-\cos^2B$ $=1-\left(\frac{2}{\sqrt{5}}\right)^2$ $=\frac{1}{5}$ $\therefore \sin B=\frac{1}{\sqrt{5}}$ *or* $\frac{\sqrt{5}}{5}$ **OR/*OF*** $(2)^2+y^2=(\sqrt{5})^2$ $4+y^2=5$ $y^2=1$ $y=1$ $\therefore \sin B=\frac{1}{\sqrt{5}}$ *or* $\frac{\sqrt{5}}{5}$  	✓ $\sin^2B=\frac{1}{5}$ ✓ answer (2) ✓ $y=1$ ✓ answer (2)

	OR/*OF* $\cos 2B = \frac{3}{5}$ $1 - 2\sin^2 B = \frac{3}{5}$ $\sin^2 B = \frac{1}{5}$ $\therefore \sin B = \frac{1}{\sqrt{5}}$ *or* $\frac{\sqrt{5}}{5}$	✓ $\sin^2 B = \frac{1}{5}$ ✓ answer (2)
5.4.3	$\cos(B + 45°) = \cos B.\cos 45° - \sin B.\sin 45°$ $= \left(\frac{2}{\sqrt{5}}\right)\left(\frac{1}{\sqrt{2}}\right) - \left(\frac{1}{\sqrt{5}}\right)\left(\frac{1}{\sqrt{2}}\right)$ $= \frac{2}{\sqrt{10}} - \frac{1}{\sqrt{10}}$ $= \frac{1}{\sqrt{10}}$ *or* $\frac{\sqrt{10}}{10}$ **OR/*OF*** $\cos(B + 45°) = \cos B.\cos 45° - \sin B.\sin 45°$ $= \left(\frac{2}{\sqrt{5}}\right)\left(\frac{\sqrt{2}}{2}\right) - \left(\frac{1}{\sqrt{5}}\right)\left(\frac{\sqrt{2}}{2}\right)$ $= \frac{2\sqrt{2}}{2\sqrt{5}} - \frac{\sqrt{2}}{2\sqrt{5}}$ $= \frac{\sqrt{2}}{2\sqrt{5}}$ *or* $\frac{\sqrt{10}}{10}$	✓ expansion ✓ $\left(\frac{1}{\sqrt{2}}\right)$ ✓ $\left(\frac{2}{\sqrt{5}}\right)$ & $\left(\frac{1}{\sqrt{5}}\right)$ ✓ answer (4) ✓ expansion ✓ $\left(\frac{1}{\sqrt{2}}\right)$ ✓ $\left(\frac{2}{\sqrt{5}}\right)$ & $\left(\frac{1}{\sqrt{5}}\right)$ ✓ answer (4)
		[21]

Question 6 **November 2016**

6.1		✓ *x*- intercepts/ *afsnitte* ✓ *y*- intercept/ *afsnit* ✓ turning pts/ *draaipte* (3)

6.2	$f(x)-3=2\sin 2x-3$ $\therefore$ maximum value $=2-3=-1$	✓ ✓ answer (2)
6.3	$2\sin 2x=-\cos 2x$ $\tan 2x=-\frac{1}{2}$ $ref\angle=26{,}57°$ $2x=153{,}43°+k.180°;k\in Z$ $x=76{,}72°+k.90°;k\in Z$ *or* $x=-13.28°+k.90°,k\in Z$ **OR/*OF*** $2\sin 2x=-\cos 2x$ $\tan 2x=-\frac{1}{2}$ $ref\angle=26{,}57°$ $2x=153{,}43°+k.360°$ *or* $333{,}43°+k.360°,k\in Z$ $x=76{,}72°+k.180°$ *or* $166{,}72°+k.180°$; $k\in Z$	✓ $\tan 2x=-\frac{1}{2}$ ✓ $2x=153{,}43°$ or $-26{,}56°$ ✓ $76{,}72°$ or $-13{,}28°$ ✓ $k.90°;k\in Z$ (4) ✓ $\tan 2x=-\frac{1}{2}$ ✓ $2x=153{,}43°$ & $333{,}43°$ ✓ $76{,}72°$ & $166{,}72°$ ✓ $k.180°;k\in Z$ (4)
6.4	$x\in(-103{,}28°;-13{,}28°)$ **OR/*OF*** $-103{,}28°<x<-13{,}28°$	✓✓ values ✓notation (3) ✓✓ values ✓notation (3) **[12]**

Question 7 November 2016

7.1	$DB^2=3^2+3^2$ [Theorem of Pyth] $=18$ $DB=\sqrt{18}$ $OB=\frac{1}{2}DB=\frac{\sqrt{18}}{2}$ *or* $\frac{3}{\sqrt{2}}$ *or* $\frac{3\sqrt{2}}{2}$ *or* $2{,}12$ **OR/*OF*** $\sin 45°=\frac{OB}{3}$ $OB=3\sin 45°$ $OB=\frac{3\sqrt{2}}{2}$ *or* $\frac{3}{\sqrt{2}}$ *or* $2{,}12$ **OF/OR**	✓ substitution into Pyth ✓ value of DB ✓ answer (3) ✓ correct ratio ✓ OB as subject ✓ answer (3)

	$\cos 45° = \frac{OB}{3}$ $\frac{1}{\sqrt{2}} = \frac{OB}{3}$ $OB = \frac{3}{\sqrt{2}}$ or $\frac{3\sqrt{2}}{2}$ or $2{,}12$	✓ correct ratio ✓ special angle ✓ answer (3)

	OR/OF $A\hat{O}B = 90°$ (diagonals bisect ⊥) $OB = OA$ $AB^2 = AO^2 + BO^2$ [pyth] $\therefore AB^2 = 2OB^2$ $2OB^2 = 3^2$ $\therefore OB = \frac{3}{\sqrt{2}}$ or $\frac{3\sqrt{2}}{2}$ or 2,12	✓ OB = OA ✓ Pyth ✓ answer (3)
7.2	$BE^2 = EO^2 + OB^2$ (Pyth) $BE^2 = x^2 + \left(\frac{3}{\sqrt{2}}\right)^2$ $BE = \sqrt{x^2 + \frac{9}{2}}$ $AE^2 = AB^2 + EB^2 - 2AB.EB\cos\theta$ $\cos\theta = \frac{AB^2 + EB^2 - AE^2}{2AB.EB} = \frac{AB^2}{2AB.EB}$ [EB = AE] $\cos\theta = \frac{AB}{2EB}$ $\cos\theta = \frac{3}{2\sqrt{x^2 + \frac{9}{2}}}$ **OR/OF**	✓ substitution into Pyth ✓ length of BE ✓ correct cosine rule ✓ cos θ as subject ✓ simplification (5) 5

$BE^2 = EO^2 + OB^2$ (Pyth)

$BE^2 = x^2 + \left(\frac{3}{\sqrt{2}}\right)^2$

$BE = \sqrt{x^2 + \frac{9}{2}}$

$AE^2 = AB^2 + EB^2 - 2AB.EB\cos\theta$

$\left(\sqrt{x^2+\frac{9}{2}}\right)^2 = 9 + \left(\sqrt{x^2+\frac{9}{2}}\right)^2 - 2(3)\left(\sqrt{x^2+\frac{9}{2}}\right).\cos\theta$

$\cos\theta = \frac{9}{6\sqrt{x^2+\frac{9}{2}}}$

$= \frac{3}{2\sqrt{x^2+\frac{9}{2}}}$

✓ substitution into Pyth
✓ length of BE
✓ correct cosine rule
✓ substituting
✓ cos θ as subject

(5)

OR/*OF*

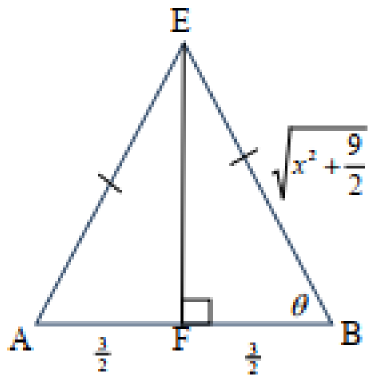
$BE^2 = EO^2 + OB^2$ (Pyth)

$BE^2 = x^2 + \left(\frac{3}{\sqrt{2}}\right)^2$

$BE = \sqrt{x^2 + \frac{9}{2}}$

$\cos\theta = \frac{\frac{3}{2}}{\sqrt{x^2+\frac{9}{2}}}$

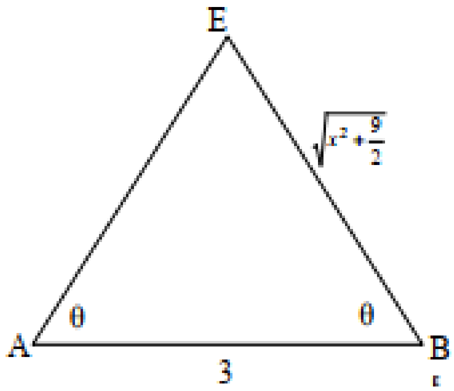
$= \frac{3}{2\sqrt{x^2+\frac{9}{2}}}$



✓ substitution into Pyth
✓ length of BE
✓ sketch with values
✓ $\frac{3}{2}$
✓ substitution

(5)

OR/OF

	$\hat{E} = 180° - 2\theta$ $\sin E = \sin 2\theta$ $\therefore \frac{3}{\sin 2\theta} = \frac{\sqrt{x^2 + \frac{9}{2}}}{\sin \theta}$ $\therefore \frac{3}{2\sin\theta\cos\theta} = \frac{\sqrt{x^2 + \frac{9}{2}}}{\sin \theta}$ $\therefore \frac{3}{2\cos\theta} = \sqrt{x^2 + \frac{9}{2}}$ $\cos\theta = \frac{3}{2\sqrt{x^2 + \frac{9}{2}}}$ 	✓ $\hat{E} = 180° - 2\theta$ ✓ $\sin E = \sin 2\theta$ ✓ subst into sine rule ✓ diagram ✓ $2\sin\theta\cos\theta$ (5)
7.3	$\text{Volume} = \frac{1}{3}(\text{area of base}) \times (\perp \text{height})$ $15 = \frac{1}{3}(9) \times x$ $x = 5$ $\cos\theta = \frac{3}{2\sqrt{25 + \frac{9}{2}}}$ $\therefore \theta = 73{,}97°$	✓ substitution ✓ x-value ✓ substitution ✓ answer (4) **[12]**

Question 8 **November 2014**

8.1.1	$x = 96°$ (∠ at centre = 2∠ at circumference/ *∠ by midpt = 2∠ by omtrek*)	✓ S ✓ R (2)
8.1.2	$\hat{C}_2 + \hat{B}_2 = 180° - 96° = 84°$ (sum of ∠s in Δ/ *som v∠e in Δ*) $y = \hat{B}_2 = 42°$ (∠s opp = sides/*∠e teenoor = sye*)	✓ S ✓ S (2)

8.2.1	$\hat{F}_1 = 90°$ (line from centre to midpt chord/ *lyn vanaf midpt na midpt kd)*	✓ S ✓ R (2)
8.2.2	$A\hat{B}C = 150°$ (opposite ∠s of cyclic quad/ *tos ∠e v koordevh*)	✓ S ✓ R (2)

8.3.1 (a)	tangent ⊥ radius/diameter / *raaklyn ⊥ radius/middellyn*	✓ R (1)
8.3.1 (b)	tangents from common pt **OR** tangents from same pt / *raaklyne v gemeensk pt **OF** raaklyne vanaf dies pt*	✓ R (1)
8.3.2	$AB^2 + BC^2 = AC^2$ $x^2 + (x+7)^2 = 13^2$ (Theorem of/*Stelling van*Pythagoras) $x^2 + x^2 + 14x + 49 = 169$ $2x^2 + 14x - 120 = 0$ $x^2 + 7x - 60 = 0$ $(x-5)(x+12) = 0$ $x = 5 \quad (x \neq -12)$	✓ $AB^2 + BC^2 = AC^2$ ✓ $x^2 + (x+7)^2 = 13^2$ ✓ standard form ✓ answer (4) **[14]**

Question 9 **November 2014**

9.1.1	Same base (DE) and same height (between parallel lines) *Dieselfde basis (DE) en dieselfde hoogte (tussen ewewydige lyne)*	✓ same base/*dies basis* between || lines/ *tussen || lyne* (1)
9.1.2	$\frac{AD}{DB}$ $\frac{\frac{1}{2}AE \times k}{\frac{1}{2}EC \times k}$ But/*Maar* area ΔDEB = area ΔDEC (Same base and same height/*dieselfde basis en dieselfde hoogte*) $\therefore \frac{\text{area } \Delta ADE}{\text{area } \Delta DEB} = \frac{\text{area } \Delta ADE}{\text{area } \Delta DEC}$ $\therefore \frac{AD}{DB} = \frac{AE}{EC}$	✓ S ✓ S ✓ S ✓ R ✓ S (5)

9.2.1	$\frac{EM}{AM}=\frac{FD}{AD}$ (Line parallel one side of Δ **OR** prop th; EF || BD) (*Lyn ewewydig aan sy v Δ* ***OF*** *eweredigst; EF ||BD)* $\frac{EM}{AM}=\frac{3}{7}$	✓ S ✓R ✓ answer/*antw* (3)
9.2.2	CM = AM (diags of parm bisect/*hoekl parm halv*) $\frac{CM}{ME}=\frac{AM}{ME}=\frac{7}{3}$ (from 9.2.1/*vanaf 9.2.1*)	✓ S ✓R ✓ answer/*antw* (3)
9.2.3	h of ΔFDC = h of ΔBDC (AD || BC) $\frac{\text{area } \Delta FDC}{\text{area } \Delta BDC}=\frac{\frac{1}{2}FD.h}{\frac{1}{2}BC.h}$ $=\frac{FD}{AD}$ (opp sides of parm =) *(tos sye v parm =)* $=\frac{3}{7}$ **OR/*OF*** $\frac{\text{area } \Delta FDC}{\text{area } \Delta ADC}=\frac{FD}{AD}=\frac{3}{7}$ (same heights) *(dieselfde hoogtes)* But Area ΔADC = Area ΔBDC (diags of parm bisect area) *(hoekl v parm halv opp)* $\frac{\text{area } \Delta FDC}{\text{area } \Delta BDC}=\frac{3}{7}$	✓ AD || BC ✓ subst into area form/ *subst in opp formule* ✓ S ✓ answer/*antw* (4) ✓ S ✓ R ✓ S ✓ answer/*antw* (4) **[16]**

Question 10 **November 2014**

10.1.1	Tangent chord theorem/*Raaklyn-koordstelling*	✓ R (1)
10.1.2	Tangent chord theorem/*Raaklyn-koordstelling*	✓ R (1)
10.1.3	Corresponding angles equal/*Ooreenkomstige ∠e gelyk*	✓ R (1)
10.1.4	∠s subtended by chord PQ **OR** ∠s in same segment *∠e onderspan deur dieselfde koord* ***OF*** *∠e in dieselfde segment*	✓ R (1)
10.1.5	alternate ∠s/*verwisselende ∠e* ; WT || SP	✓ R (1)

10.2	$\frac{RW}{RS}=\frac{RT}{RP}$ $\therefore RT=\frac{WR.RP}{RS}$ **OR/*OF*** $\Delta RTW \mid\mid\mid \Delta RPS$ $\therefore \frac{RW}{RS}=\frac{RT}{RP}$ $\therefore RT=\frac{RW.RP}{RS}$	(Line parallel one side of Δ **OR** prop th; WT || SP) *(Lyn ewewydig aan sy v Δ* ***OF*** *eweredighst: WT || SP)* (∠; ∠; ∠) (ΔRTW ||| ΔRPS)	✓S ✓R (2) ✓S ✓S (2)
10.3	$y=\hat{T}_2=\hat{R}_3$ $y=\hat{R}_3=\hat{Q}_1$	(tan chord theorem/*Rkl-koordst*) (∠s in same segment/*∠e in dieselfde segment*)	✓S ✓R ✓S ✓R (4)

10.4	$\hat{Q}_3=P\hat{S}R$ $P\hat{S}R=\hat{W}_2$ $\therefore \hat{Q}_3=\hat{W}_2$ **OR/OF** $\hat{Q}_2=x$ $\hat{Q}_3=180°-(x+y)$ $\hat{W}_2=180°-(x+y)$ $\therefore \hat{Q}_3=\hat{W}_2$	(ext ∠ of cyc quad/*buite∠v kdvh*) (corresp∠s/*ooreenk ∠e* ; WT || SP) (∠s in same segment/*∠e in dies segment*) (∠s on straight line/*∠e op reguitlyn*) (∠s of ΔWRT/*∠e v ΔWRT*)	✓S ✓R ✓S (3) ✓R ✓S ✓S (3)
10.5	In ΔRTS and ΔRQP: $\hat{R}_3=\hat{R}_2=y$ $\hat{S}_2=\hat{P}_2$ $R\hat{T}S=R\hat{Q}P$ $\therefore \Delta RTS \mid\mid\mid \Delta RQP$	 (proven above/*hierbo bewys*) (∠s in same segment/*∠e in dies segment*) (3^{rd} angle of Δ) (∠; ∠; ∠)	 ✓S ✓S/R ✓S **OR/OF** (∠; ∠; ∠) (3)

10.6	$\frac{RT}{RQ}=\frac{RS}{RP}$ (ΔRTS ||| ΔRQP) $\frac{RS}{RP}\times\frac{RS}{RP}=\frac{RT}{RQ}\times\frac{RS}{RP}$ $\left(\frac{RS}{RP}\right)^2=\left(\frac{RT}{RP}\right)\left(\frac{RS}{RQ}\right)$ $=\left(\frac{RW}{RS}\right)\left(\frac{RS}{RQ}\right)$ (proven in 10.2/*bewys in 10.2*) $=\frac{RW}{RQ}$	✓ S ✓ $\times\frac{RS}{RP}$ on both sides ✓ $\left(\frac{RT}{RP}\right)\left(\frac{RS}{RQ}\right)$ (3)
	OR/OF $\frac{RT}{RQ}=\frac{RS}{RP}$ (ΔRTS ||| ΔRQP) But $RT=\frac{WR.RP}{RS}$ (proven in 10.2/*bewys in 10.2*) $\therefore\frac{RT}{RQ}=\frac{WR.RP}{RQ.RS}=\frac{RS}{RP}$ $WR.RP^2=RQ.RS^2$ $\therefore\frac{WR}{RQ}=\frac{RS^2}{RP^2}$	✓ S ✓ $RT=\frac{WR.RP}{RS}$ ✓multiplication/ *vermenigvuldig* (3)
	OR/OF $\frac{RT}{RS}=\frac{RQ}{RP}$ (ΔRTS ||| ΔRQP) $RQ=\frac{RT.RP}{RS}$ and $WR=\frac{RT.RS}{RP}$ (proven in 10.2/*bewys in 10.2*) $\frac{WR}{RQ}=\frac{\frac{RT.RS}{RP}}{\frac{RT.RP}{RS}}$ $=\frac{RT.RS}{RP}\times\frac{RS}{RT.RP}$ $=\frac{RS^2}{RP^2}$	✓ S ✓ $WR=\frac{RT.RS}{RP}$ ✓ simplification/ *vereenvoudiging* (3) **[20]**

Question 7 **Feb March 2015**

7.1	MB = 10 cm	✓ answer/*antw* (1)
7.2	line from centre to midpoint of chord is perpendicular to chord/*lyn vanaf midpt na midpt van koord is loodreg op koord* **OR/*OF*** line from centre bisects chord/*lyn vanaf midpt halveer koord*	✓ answer/*antw* (1) ✓ answer/*antw* (1)
7.3	$\frac{MP}{OM}=\frac{5}{2}$ $\frac{x+OP}{x}=\frac{5}{2}$ $2x+2OP=5x$ $OP=\frac{3x}{2}$ **OR/*OF*** $\frac{OP}{OM}=\frac{3}{2}$ $OP=\frac{3x}{2}$	✓ $\frac{x+OP}{x}=\frac{5}{2}$ ✓ $OP=\frac{3x}{2}$ (2) ✓ $\frac{OP}{OM}=\frac{3}{2}$ ✓ $OP=\frac{3x}{2}$ (2)
7.4	$OM^2+MB^2=OB^2$ $x^2+10^2=\left(\frac{3x}{2}\right)^2$ $4x^2+400=9x^2$ $5x^2=400$ $x^2=80$ $x=8{,}94$ or $4\sqrt{5}$ or $\sqrt{80}$	✓ subst into/*subst* Pythagoras ✓ $4x^2+400=9x^2$ ✓ answer/*antw* (3) [7]

Question 8 **Feb March 2015**

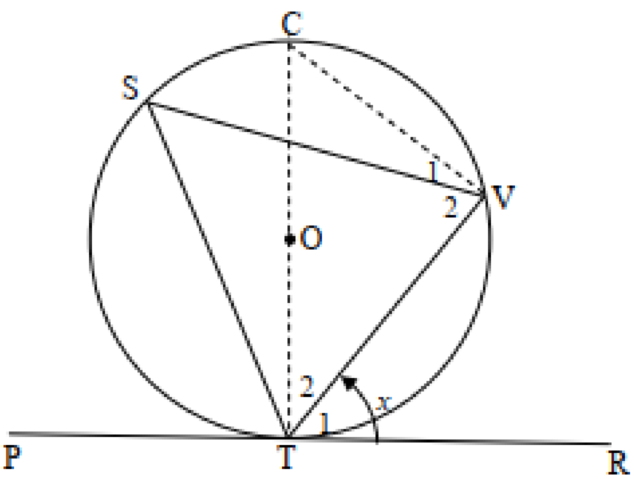
8.1.1	$\hat{D}=\frac{1}{2}\hat{O}_1=55°$ ($\angle$ at centre=2×$\angle$at circ/$\angle$ *by midpt=2×$\angle$by omt*)	✓S ✓R (2)
8.1.2	$\hat{A}=\frac{1}{2}\hat{O}_1=55°$ ($\angle$ at centre=2×$\angle$at circ/$\angle$ *by midpt=2×$\angle$by omt*) **OR/*OF*** $\hat{A}=\hat{D}=55°$ ($\angle$s in same segment/$\angle$*e in dieselfde segment*)	✓S ✓R (2) ✓S ✓R (2)

8.1.3	$\hat{B}_1 = \hat{D} = 55°$ (alternate ∠s/*verwiss*∠*e*; AB || DC) $\hat{E}_2 = \hat{B}_1 + \hat{A}$ (ext∠ ofΔ = sum of opp∠'s/*buite*∠*v*Δ=*som v tos*∠*e*) $= 55° + 55°$ $\hat{E}_2 = 110°$	✓S ✓R ✓R ✓ answer/*antw* (4)
8.2	$\hat{E}_2 = \hat{O}_1 = 110°$ (proven in/*bewys in* 8.1.3) BEOC is a cyclic quadrilateral (equal ∠s subtended by line/ *gelyke* ∠*e onderspan deur lyn*)	✓S ✓R (2) **[10]**

Question 9 **Feb March 2015**

9.1	the interior opposite angle/*die teenoorstaande binnehoek.*	✓ answer/*antw* (1)

9.2



Construction: Draw diameter CT and join CV.
Konstruksie: Trek middellyn CT en verbind CV.

$\hat{V}_1 + \hat{V}_2 = 90°$	**∠ in semi-circle/∠*in halfsirkel***	✓ S ✓ R
$\hat{T}_2 = 90° - x$	**Tangent ⊥ diameter/radius/*raaklyn ⊥ middellyn/radius***	✓ R
$\therefore \hat{C} = x$	Sum of the angles of triangle/*Som van die hoeke van 'n driehoek*	✓ S
$\therefore \hat{S} = x$	**∠'s same segment/∠*e in dieselfde segment***	✓ R
$\therefore V\hat{T}R = \hat{S}$		(5)

9.3.1	Equal chords subtend equal ∠s/*Gelyke koorde onderspan gelyke ∠e*	✓ R (1)
9.3.2	$\hat{W}_4 = 30°$ (tan chord theorem/*rkl-koordst*) $\hat{W}_1 = 30°$	✓ answer/*antw* ✓ reason/*rede* ✓ answer/*antw* (3)
9.3.3(a)	$\hat{R}_4 = \hat{W}_2 = 50°$ (tan chord theorem/*rkl-koordst*) $\hat{S}_2 = \hat{R}_3 + \hat{W}_2$ (ext∠ of Δ/*buite ∠v Δ*) $\therefore \hat{S}_2 = 80°$ **OR/*OF*** $\hat{R}_2 = \hat{R}_3 = 30°$ (= chords subtend =∠s /= *kde onderspan*=∠*e*) $\hat{R}_4 = \hat{W}_2 = 50°$ (tan chord theorem/*rkl-koordst*) $\therefore \hat{S}_2 = 80°$	✓ S ✓R ✓ S (3) ✓ S ✓R ✓ S (3)
9.3.3(b)	$\hat{T}_2 = \hat{S}_2 = 80°$ (ext ∠ of cyclic quad/*buite∠ van koordevh*) $V + \hat{W}_4 = \hat{T}_2$ (ext∠ of Δ/*buite∠ van Δ*) $\therefore \hat{V} = 50°$	✓ S ✓ R ✓ S ✓ S (4)
9.3.4	In ΔRVW and/*en* ΔRWS: $\hat{R}_2 = \hat{R}_3 = 30°$ (proven/*bewys* in 9.3.1) $\hat{V} = \hat{W}_2 = 50°$ (proven/*bewys* in 9.3.3) $V\hat{W}R = \hat{S}_1$ (3rd ∠ in Δ) ∴ΔRVW ||| ΔRWS (∠∠∠) $\therefore \frac{WR}{RV} = \frac{RS}{WR}$ (ΔRVW ||| ΔRWS) $\therefore WR^2 = RV.RS$	✓ using the correct Δs/ *gebruik korrekte Δe* ✓ S ✓ S ✓ R (3rd ∠ in Δ) or (∠∠∠) ✓ S (5) **[22]**

Question 10 **Feb March 2015**

10.1.1	corresponding ∠s/*ooreenkomstige∠e*; PN || RT	✓ answer/*antw* (1)
10.1.2	∠; ∠; ∠ **OR/*OF*** ∠; ∠	✓ answer/*antw* (1)

10.2	$\frac{PM}{RM}=\frac{PN}{RT}$ $(\Delta PNM \parallel\!\mid \Delta RTM)$ $=\frac{PN}{3PN}$ $=\frac{1}{3}$	✓ S ✓ S (2)
10.3	$\frac{PM}{RM}=\frac{1}{3}$ $\therefore \frac{RP}{RM}=\frac{2}{3}$ $RN^2-PN^2=(RM^2+NM^2)-(PM^2+NM^2)$ (Pyth) $=RM^2-PM^2$ $=\left(\frac{3}{2}RP\right)^2-\left(\frac{1}{2}RP\right)^2$ $=\frac{9}{4}RP^2-\frac{1}{4}RP^2$ $=2RP^2$ **OR/*OF***	✓ Use of Pyth. for RN^2 and PN^2 ✓ $RM=\frac{3}{2}RP$ ✓ $PM=\frac{1}{2}RP$ ✓ $\frac{9}{4}RP^2$ & $\frac{1}{4}RP^2$ (4)
	$RN^2-PN^2=(RM^2+NM^2)-(PM^2+NM^2)$ (Pyth) $=RM^2-PM^2$ $=(3PM)^2 \quad PM^2$ $=8PM^2$ $=2(2PM)^2$ $=2RP^2$ **OR/*OF*** $RN^2-PN^2=(RM^2+NM^2)-(PM^2+NM^2)$ (Pyth) $=RM^2-PM^2$ $=(RP+PM)^2-PM^2$ $=RP^2+2RP.PM+PM^2-PM^2$ $=RP^2+2RP.\frac{1}{2}RP$ $=2RP^2$	✓ Use of Pyth. for RN^2 and PN^2 ✓ $RM=RP+PM$ ✓ $(3PM)^2-PM^2$ ✓ $RP=2PM$ (4) ✓ Use of Pyth. for RN^2 and PN^2 ✓ $RM=RP+PM$ ✓ expansion/ *uitbreiding* ✓ $PM=\frac{1}{2}RP$ (4) **[8]**

Question 8 **November 2015**

8.1.1	twice or double /*twee keer of dubbel*	✓ R (1)

8.1.1	twice or double /*twee keer of dubbel*	✓R (1)
8.1.2	$\hat{O}_1 = 2\hat{A}$ [∠ at centre = 2×∠ at circ/*midpts∠ =2×omtreks∠*] $\hat{O}_2 = 2\hat{C}$ [∠ at centre = 2×∠ at circ/*midpts∠ =2×omtreks∠*] $\hat{O}_1 + \hat{O}_2 = 360°$ [∠s in a rev/*∠e in omw of om 'n pt*] $2\hat{A} + 2\hat{C} = 360°$ $\therefore \hat{A} + \hat{C} = 180°$ **OR/OF** Let/*Gestel* $\hat{O}_1 = 2x$ $\hat{A} = x$ [∠ at centre = 2×∠ at circ/*midpts∠ =2×omtreks∠*] $\hat{O}_2 = 360° - 2x$ [∠s in a rev/*∠e in omw of om 'n pt*] $\hat{C} = 180° - x$ [∠ at centre = 2×∠ at circ/*midpts∠ =2×omtreks∠*] $\therefore \hat{A} + \hat{C} = 180°$	✓S ✓S ✓S (3) ✓S ✓S ✓S (3)

8.2	$\hat{A} = \hat{C}_2$ [ext ∠ of cyclic quad/*buite∠ v kdvh*] $\hat{E} = 180° - \hat{C}_2$ [opp ∠s of cyclic quad/*tos∠e v kdvh*] $\therefore \hat{E} = 180° - \hat{A}$ ∴ EF || AB [co-interior ∠s 180°/*ko-binne∠e 180°*] **OR/*OF*** $\hat{B} = \hat{D}_1$ [ext ∠ of cyclic quad/*buite∠ v kdvh*] $\hat{F} = 180° - \hat{D}_1$ [opp ∠s of cyclic quad/*tos∠e v kdvh*] $\therefore \hat{F} = 180° - \hat{B}$ ∴ EF || AB [co-interior ∠s 180°/*ko-binne∠e 180°*]	✓S ✓R ✓S ✓R ✓R (5) ✓S ✓R ✓S ✓R ✓R (5) **[9]**

Question 9 **November 2015**

9.1	$\hat{K}_3 = \hat{C}$ [corresp ∠s/*ooreenk ∠e* ; CA| |KT] $= \hat{A}_3$ [tan-chord th/*raakl-koordst*] $= x$	✓S ✓R ✓S ✓R (4)
9.2	$\hat{K}_3 = x = \hat{A}_3$ [proved/*bewys* in 9.1] ∴ AKBT is cyc quad [line (BT) subtends equal ∠s/ *lyn (BT) onderspan gelyke ∠e*] **OR/OF** [converse ∠s in same segment/ *omgek ∠e in dies segment*]	✓S ✓R (2)

9.3	$\hat{K}_3 = \hat{C}$ $= \hat{B}_2$ $= \hat{K}_2$ $\therefore$ TK bisects/*halveer* $A\hat{K}B$ **OR/*OF*** $\hat{K}_2 = \hat{B}_2$ $= \hat{A}_3$	[proven in 9.1] [tan-chord th/*raakl-koordst*] [∠s in the same segm/∠*e in dies segm*] [∠s in the same seg/∠*e in dies segm*] [tans from same pt; ∠s opp equal sides/ *rkle v dies pt; ∠e to gelyke sye*]	✓S ✓R ✓S ✓R (4) ✓S ✓R ✓S ✓R

Question 10 **November 2015**

10.1	$B\hat{D}C = 90°$ $DC^2 = 17^2 - 8^2$ $= 225$ $\therefore DC = 15$	[∠ in semi circle/∠ *in halfsirkel*] [Th of/*stelling v* Pythagoras]	✓ S ✓ using/*gebruik* Pyth *korrek/* correctly ✓ answ/*antw* (3)
10.2.1	$\frac{CF}{CD} = \frac{CE}{CB}$ $\therefore \frac{CF}{15} = \frac{1}{4}$ $\therefore CF = 3{,}75$	[line | | one side of Δ/*lyn* | | *een sy van* Δ] **OR/*OF*** ΔCEF | | | ΔCBD	✓ S/R ✓ subst correctly/ *korrek* ✓ answ/*antw* (3)
10.2.2	$B\hat{D}C = 90°$ $E\hat{F}C = B\hat{D}C$ $A\hat{B}C = 90°$ In ΔBAC and/*en* Δ FEC: $A\hat{B}C = E\hat{F}C$ $\hat{C} = \hat{C}$ $\therefore$ ΔBAC | | | Δ FEC **OR/*OF*** $B\hat{D}C = 90°$ $E\hat{F}C = B\hat{D}C$ $A\hat{B}C = 90°$ In ΔBAC and/*en* Δ FEC: $A\hat{B}C = E\hat{F}C$ $\hat{C} = \hat{C}$	[∠ in semi circle/∠ *in halfsirkel*] [corresp ∠s/*ooreenk* ∠*e*; EF| |BD] [tan ⊥ diameter/*raakl* ⊥ *middellyn*] [proven/bewys] [common/*gemeen*] [∠∠∠] [∠ in semi circle/∠ *in halfsirkel*] [corresp ∠s/*ooreenk* ∠*e*; EF| |BD] [tan ⊥ diameter/*raakl* ⊥ *middellyn*] [proven/bewys] [common/*gemeen*]	✓ S/R ✓ S ✓ R ✓ S ✓ R (5) ✓ S/R ✓ S ✓ R ✓ S

	$B\hat{A}C = F\hat{E}C$ $\therefore$ ΔBAC | | | Δ FEC	[∠ sum in Δ/∠ *som van* Δ]	✓ S (5)

10.2.3	$EC = \frac{1}{4} \times 17 = 4{,}25$ $\frac{AC}{EC} = \frac{BC}{FC}$ [$\Delta BAC \parallel\mid \Delta FEC$] $\frac{AC}{4{,}25} = \frac{17}{3{,}75}$ $\therefore AC = 19{,}27$ or/*of* $19\frac{4}{15}$	✓ length of/*lengte v* EC ✓ S ✓ subst correctly/ *korrek* ✓ answ/*antw* (4)
	OR/*OF* $\cos \hat{C} = \frac{CF}{CE} = \frac{BC}{AC}$ $\therefore \frac{3{,}75}{4{,}25} = \frac{17}{AC}$ $\therefore AC = 19{,}27$ or/*of* $19\frac{4}{15}$	✓✓ correct ratios/ *korrekte verh's* ✓ subst correctly/ *korrek* ✓ answ/*antw* (4)
	OR/*OF* $\Delta BCA \parallel\mid \Delta DBC$ $CB^2 = CD \cdot AC$ $AC = \frac{BC^2}{DC}$ $= \frac{17^2}{15}$ $= 19{,}27$ or/*of* $19\frac{4}{15}$	✓ S **OR** Pyth th ✓ correct ratio ✓ subst ✓ answ/*antw* (4)
	OR/*OF* $\hat{C} = A\hat{B}D$ [tan-chord theorem/*rkl-kdstelling*] $\frac{AD}{8} = \tan A\hat{B}D$ $= \tan\hat{C}$ $= \frac{8}{15}$ $\therefore AD = \frac{64}{15}$ $\therefore AC = 19{,}27$ or/*of* $19\frac{4}{15}$	✓ S ✓ correct ratio ✓ subst ✓ answ/*antw* (4)

10.2.4	AC is diameter of the circle passing through A, B and C [chord subtends 90° **OR** converse ∠ in semi circle] *AC is middellyn van die sirkel wat deur die punte A, B en C gaan* *[koord onderspan 90° **OF** omgek ∠ in halfsirkel]* $\therefore$radius $= \frac{1}{2} \times 19{,}27 = 9{,}63$ or/*of* $9\frac{19}{30}$ or/*of* $\frac{1}{2}AC$	✓ S/R ✓ answ/*antw* (2) **[17]**

Question 11 **November 2015**

11.1	equiangular or similar/*gelykhoekig of gelykvormig*	✓ answ/*antw* (1)
11.2.1	$\frac{KP}{RN}=\frac{1,5}{0,75}=2$; $\frac{PM}{NM}=\frac{2}{1}=2$; $\frac{KM}{RM}=\frac{2,5}{1.25}=2$ $\therefore \frac{KP}{RN}=\frac{PM}{NM}=\frac{KM}{RM}$ $\therefore \Delta KPM\ \vert\vert\vert\ \Delta RNM$ [Sides of Δ in prop/*sye v Δ eweredig*]	✓✓✓ all 3 statements/ *al 3 bewerings* (3)
	OR/*OF*	
	$\frac{RN}{KP}=\frac{0,75}{1,5}=\frac{1}{2}$; $\frac{NM}{PM}=\frac{1}{2}$; $\frac{RM}{KM}=\frac{1,25}{2,5}=\frac{1}{2}$ $\therefore \frac{RN}{KP}=\frac{NM}{PM}=\frac{RM}{KM}$ $\therefore \Delta KPM\ \vert\vert\vert\ \Delta RNM$ [Sides of Δ in prop/*sye v Δ eweredig*]	✓✓✓ all 3 statements/ *al 3 bewerings* (3)
	OR/*OF*	
	In ΔMNR: $1,25^2=1^2+0,75^2=1,5625$ $\therefore M\hat{N}R=90°$ [converse Pyth theorem] In ΔPKM: $2,5^2=1,5^2+2^2=6,25$ $\therefore \hat{P}=90°$ [converse Pyth theorem] $\cos P\hat{K}M=\frac{1,5}{2,5}=\frac{3}{5}$ and $\cos \hat{R}=\frac{0,75}{1,25}=\frac{3}{5}$ $\therefore P\hat{K}M=\hat{R}$ In ΔKPM and ΔRNM $P\hat{K}M=\hat{R}$ [proved] $\hat{P}=M\hat{N}R$ [proved] $\therefore \Delta KPM\ \vert\vert\vert\ \Delta RNM$ [∠;∠;∠ OR 3rd ∠]	✓ $\hat{P}=M\hat{N}R$ ✓ $P\hat{K}M=\hat{R}$ ✓[∠;∠;∠ OR 3rd ∠] (3)
11.2.2	$P\hat{K}M=\hat{R}$ [ΔKPM ||| ΔRNM] $\therefore \hat{P}$ is common/*gemeen* $\therefore \Delta RPQ\ \vert\vert\vert\ \Delta KPM$ [∠∠∠] $\frac{RP}{KP}=\frac{RQ}{KM}$ [ΔRPQ ||| ΔKPM] $\therefore \frac{3,25}{1,5}=\frac{RQ}{2,5}$ $\therefore RQ=\frac{2,5\times 3,25}{1,5}=5,42$ or $5\frac{5}{12}$ $\therefore NQ=5,42-0,75=4,67$ or $4\frac{2}{3}$	✓ S ✓ ΔRPQ|||ΔKPM ✓ S ✓ subst correctly/ *korrek* ✓ $RQ=5\frac{5}{12}$ ✓ NQ = answ/*antw* (6)
	OR/OF	

	$R\hat{N}M = \hat{P}$ [ΔKPM ||| ΔRNM] $\therefore$ $\hat{R}$ is common/*gemeen* $\therefore$ ΔRNM ||| ΔRPQ [∠∠∠] $\frac{RP}{RN} = \frac{RQ}{RM}$ [ΔRNM ||| ΔRPQ] $\therefore \frac{3,25}{0,75} = \frac{RQ}{1,25}$ $\therefore RQ = 5,42 \text{ or } 5\frac{5}{12}$ $\therefore NQ = 5,42 - 0,75 = 4,67 \text{ or } 4\frac{2}{3}$	✓ S ✓ ΔRNM ||| ΔRPQ ✓ S ✓ subst correctly/ *korrek* ✓ $RQ = 5\frac{5}{12}$ ✓ NQ = answ/*antw* (6)
	OR/*OF* In ΔMNR: $1,25^2 = 1^2 + 0,75^2 = 1,5625$ $\therefore M\hat{N}R = 90°$ [converse Pyth theorem] In ΔPKM: $2,5^2 = 1,5^2 + 2^2 = 6,25$ $\therefore \hat{P} = 90°$ [converse Pyth theorem] In ΔMNR and ΔQPR ∠R is common $M\hat{N}R = \hat{P} = 90°$ $\therefore$ ΔMNR ||| ΔQPR [∠∠∠] $\frac{RP}{RN} = \frac{RQ}{RM}$ [ΔRNM ||| ΔRPQ] $\therefore \frac{3,25}{0,75} = \frac{RQ}{1,25}$ $\therefore RQ = 5,42 \text{ or } 5\frac{5}{12}$ $\therefore NQ = 5,42 - 0,75 = 4,67 \text{ or } 4\frac{2}{3}$	✓ S ✓ ΔMNR ||| ΔQPR ✓ S ✓ subst correctly/ *korrek* ✓ $RQ = 5\frac{5}{12}$ ✓ NQ = answ/*antw* (6) **[10]**

Question 8 **Feb March 2016**

8.1.1	$\hat{K}_2 = \hat{M}_2 = 40°$ [tan chord theorem/*raakl-kdst*]	✓S ✓R (2)
8.1.2	$\hat{N}_1 = \hat{K}_1$ [∠s in the same seg/*∠e in dies segm*] $\hat{K}_1 = 84° - 40° = 44°$ $\therefore \hat{N}_1 = 44°$	✓S ✓R ✓S (3)
8.1.3	$\hat{T} = \hat{N}_1 = 44°$ [alt/*verw* ∠s/*e*; KT || NM]	✓S ✓R (2)
8.1.4	$\hat{L}_2 = \hat{K}_2 + \hat{T}$ [ext ∠ of Δ/*buite ∠v Δ*] $= 40° + 44°$ $= 84°$	✓R ✓S (2)

8.1.5	In ΔKLM: $44° + 84° + 40° + \hat{L}_1 = 180°$ [∠s sum in Δ/*∠e som in Δ*] $\therefore \hat{L}_1 = 12°$	✓S (1)
8.2	$\hat{C} = 108°$ [opp∠s of ||m/*tos ∠e v ||m*] $2x + 40° + 108° = 180°$ [opp∠s of cyc quad/*tos∠e v kdvh*] $2x = 32°$ $x = 16°$ **OR/*OF*** $\hat{C} = 180° - (2x + 40°)$ [opp∠s of cyc quad/*tos∠e v kdvh*] $180° - (2x + 40°) = 108°$ [opp∠s of ||m/*tos ∠e v ||m*] $2x = 32°$ $x = 16°$	✓S ✓R ✓S ✓R ✓answ/*antw* (5) ✓S ✓R ✓S ✓R ✓answ/*antw* (5) **[15]**

Question 9 **Feb March 2016**

9.1	ABCD is a ||m [diags of quad bisect each other/ *hoekl v vh halveer mekaar*]	✓R (1)
9.2	$\frac{ED}{DB} = \frac{FE}{AF}$ [Prop Th/*Eweredigh st*; DF || BA] $\frac{ED}{DB} = \frac{GE}{CG}$ [Prop Th/*Eweredigh st*; DG || BC]	✓S ✓R ✓S ✓R (4)
9.3	$\frac{FE}{AF} = \frac{GE}{CG}$ [proved/*bewys*] ∴AC || FG [line divides two sides of Δ in prop/ *lyn verdeel 2 sye van Δ eweredig*] $\hat{C}_2 = \hat{F}_2$ [alt/*verw* ∠s/*e*; AC || FG] $\hat{A}_1 = \hat{C}_2$ [alt/*verw* ∠s/*e*; AB || CD] $\therefore \hat{A}_1 = \hat{F}_2$	✓S ✓S ✓R ✓S ✓S (5)
9.4	$\hat{A}_1 = \hat{A}_2$ [diags of rhombus/*hoekl v ruit*] $\hat{A}_2 = \hat{F}_2$ [$\hat{A}_1 = \hat{F}_2$] ∴ ACGF = cyc quad/*kdvh* [∠s in the same seg =/ *∠e in dies segm =*] **OR/*OF*** $\hat{C}_2 = \hat{A}_2$ [∠s opp equal sides of rhombus/ *∠e to gelyke sye v ruit*] $\hat{A}_2 = \hat{G}_2$ [alt/*verw*-∠s/*e*; AC || FG] $\therefore \hat{C}_2 = \hat{G}_2$ ∴ ACGF is a cyc quad/*kdvh* [∠s in the same seg =/ *∠e in dies segm =*]	✓S ✓S ✓R (3) ✓S ✓S ✓R (3) **[13]**

Question 10 **Feb March 2016**

10.1.1	In ΔADE and/*en* ΔPQR: AD = PQ $\hat{A} = \hat{P}$ AE = PR ∴ΔADE ≡ ΔPQR	 [construction/*konstr*] [given/*gegee*] [construction/*konstr*] [S∠S]	✓all/*al* 3 S's/*e* ✓reason/*rede* (2)
10.1.2	$A\hat{D}E = \hat{Q}$ But $\hat{B} = \hat{Q}$ ∴ $A\hat{D}E = \hat{B}$ ∴ DE | | BC	[Δs ≡ ∴ corres/*ooreenk* ∠s/*e* =] [given/*gegee*] [corres/*ooreenk* ∠s/*e* =]	✓ $A\hat{D}E = \hat{Q}$ ✓ $A\hat{D}E = \hat{B}$ ✓reason/*rede* (3)
10.1.3	$\frac{AB}{AD} = \frac{AC}{AE}$ [Prop Th/*Eweredigh st*; DE | | BC] But/*Maar* AD = PQ and/*en* AE = PR [construction/*konstr*] ∴ $\frac{AB}{PQ} = \frac{AC}{PR}$		✓S/R ✓S (2)

10.2.1	line from centre to midpt of chord/*lyn van midpt na midpt van koord*		✓answ/*antw* (1)
10.2.2	OP | | VS In ΔROP and/*en* ΔRVS: $\hat{R} = \hat{R}$ $\hat{O}_2 = \hat{V}$ ∴ΔROP | | | ΔRVS	[Midpt Theorem/*Midpt-stelling*] [common/*gemeen*] [corresp/*ooreenk* ∠s/*e*; OP | | VS] [∠,∠,∠]	✓S ✓R ✓S ✓S & ∠;∠;∠ **OR/*OF*** 3 angles/*hoeke* (4)
	OR/*OF*		
	In ΔROP and/*en* ΔRVS: $\hat{P}_2 = V\hat{S}R$ $\hat{R} = \hat{R}$ ∴ΔROP | | | ΔRVS	 [corresponding ∠s/ *ooreenkomstige* ∠'e] [common/*gemeen*] [∠,∠,∠]	✓S ✓R ✓S ✓S & ∠;∠;∠ **OR/*OF*** 3 angles/*hoeke* (4)

10.2.3	In ΔRVS and/*en* ΔRST: $V\hat{S}R = S\hat{T}R = 90°$ $\hat{R}$ is common/*gemeen* $\hat{V} = T\hat{S}R$ ∴ΔRVS | | | ΔRST	 [∠ in semi-circle/∠ *in halfsirkel*] [∠,∠,∠]	✓S ✓R ✓S & ∠;∠;∠ **OR/*OF*** 3 angles/*hoeke* (3)

10.2.4	In ΔRTS and/*en* ΔSTV: $R\hat{T}S = V\hat{T}S = 90°$ [∠ s on straight line/∠*e op rt lyn*] $\hat{R} = 90° - T\hat{S}R$ $= T\hat{S}V$ $T\hat{S}R = \hat{V}$ ∴ΔRTS ||| ΔSTV [∠,∠,∠] $\therefore \frac{RT}{ST} = \frac{TS}{VT}$ $\therefore ST^2 = VT.TR$	✓ΔRTS & ΔSTV ✓S ✓S ✓S (with justification/*met motivering*) ✓ΔRTS ||| ΔSTV ✓ratio/*verh* (6)

Question 8 **May June 2016**

8.1.1	$\hat{P} = 32°$ [opp ∠s of cyclic quad/*teenoorst∠e v koordevh*]	✓ S ✓ R (2)
8.1.2	$\hat{O}_1 = 2(32°) = 64°$ [∠ centre = 2 ∠ at circum/*midpts∠ = 2 omtreks∠*] **OR/*OF*** reflex $\hat{O} = 296°$ [∠ centre = 2 ∠ at circum/*midpts∠ = 2 omtreks∠*] $\hat{O}_1 = 64°$ [∠s around a point/*∠e om 'n punt*]	✓ S ✓R (2) ✓ S and R ✓ S (2)
8.1.3	$O\hat{M}S = 180° - (32° + 18° + 43°)$ [sum ∠s Δ / *som ∠e* Δ] $= 87°$	✓ S ✓ S (2)
8.1.4	$\hat{R}_3 = T\hat{M}P$ [ext ∠ cyclic quad/*buite ∠ koordevh*] $= 87° + 18° - 6°$ $= 99°$	✓ R ✓ S (2)
8.2.1	corres ∠s/*ooreenk ∠e*; AB || DC	✓ R (1)
8.2.2	$\hat{E}_2 = x$ [tan - chord theorem/*raakl – koordst*] $\hat{B}_2 = x$ [∠s opp = sides/*∠e teenoor = sye*] $\hat{E}_3 = x$ [alt ∠s/*verwiss ∠e*; AB || DC] $D\hat{A}B = x$ [opp ∠s ||^m /*teenoor ∠e* ||^m **OR/*OF*** alternate/*verwiss* ∠s/*e*; BC ||AD] Any 3 ∠s correct	✓S ✓R ✓ S ✓ R ✓ S ✓ R (6)
8.2.3	$\hat{D} = 180° - x$ [co - int ∠s suppl/*ko – binne∠e* suppl; AD || BC] $\therefore \hat{B}_2 + \hat{D} = 180°$ ∴ ABED a cyc quad/*kdvh* [converse opp ∠s of cyclic quad/ *omgek teenoorst ∠e koordevh*] **OR/*OF*** $D\hat{A}B = x$ [opp ∠s/*teenoor ∠e* | |^m] OR/*OF* [alt∠s/*verwiss ∠e*; BC | | AD] $\hat{E}_3 = D\hat{A}B = x$ ∴ ABED a cyc quad/*kdvh* [converse ext ∠ of cyc quad/*omgek buite∠ v koordevh*]	✓S ✓ R ✓ R (3) ✓S ✓ R ✓ R (3) **[18]**

Question 9 **May June 2016**

9.1	… in the alternate segment/…*in die(teen)oorstaande segment*	✓ answer (1)

9.2.1	$\hat{A}_1 = \hat{D}_1$ [tan chord theorem/*raakl – koordst*] $\hat{B}_4 = \hat{A}_1 + \hat{D}_2$ [ext ∠ Δ/*buite∠* Δ] $= \hat{D}_1 + \hat{D}_2$	✓S ✓R ✓S ✓R (4)
9.2.2	$\hat{B}_4 = \hat{B}_2$ [vert opp ∠s/*regoorst* ∠e] $\hat{D}_1 + \hat{D}_2 = \hat{B}_2$ [proven/*bewys*] $= \hat{G}_2$ [∠s in same segment/∠e *in dies segment*] ∴ AGCD is cyc quad/*kvh* [converse ext∠ cyc quad/*omgek buite*∠ *kvh*]	✓S ✓S ✓R ✓R (4)
9.2.3	$\hat{D}_1 = \hat{A}_2$ [∠s in same segment/∠*e in dies segment*] $\hat{A}_2 = \hat{F}$ [∠s in same segment/∠*e in dies segment*] $\therefore \hat{D}_1 = \hat{F}$ ∴ DC = CF [sides opp = ∠s/*sye teenoor* = ∠*e*]	✓S ✓R ✓S ✓R (4) **[13]**

Question 10 **May June 2016**

10.1	Constr/*Konstr* : Draw line BC such that MB = AK and MC = AF *Trek lyn BC sodat MB = AK en MC = AF* Proof/*Bewys* : In ΔBMC and/*en* ΔKAF MB = AK [constr/*konstr*] $\hat{M} = \hat{A}$ [given/*gegee*] MC = AF [constr/*konstr*] ΔBMC ≡ ΔKAF [s∠s] $\therefore M\hat{B}C = A\hat{K}F$ or $M\hat{C}B = A\hat{F}K$ [≡Δ] but /*maar* $\hat{V} = \hat{K}$ or $\hat{T} = \hat{F}$ [given/*gegee*] $\therefore M\hat{B}C = \hat{V}$ or $M\hat{C}B = \hat{T}$ But these are corresponding ∠s/*maar hulle is ooreenk* ∠*e* ∴ BC || VT [corr ∠s = /*ooreenk*∠*e* =] $\therefore \frac{MV}{MB} = \frac{MT}{MC}$ [prop theorem/*eweredighst*; BC || VT] but /*maar* MB = AK and MC = AF [constr/*konstr*] $\therefore \frac{MV}{AK} = \frac{MT}{AF}$	✓ constr/*konstr* ✓S / R ✓S ✓S ✓S / R ✓S ✓R (7)

10.2.1(a)	In ΔKGH and ΔKEF $\hat{K}$ is common/*gemeen* $\hat{H}_2 = \hat{F}$ [ext ∠ cyclic quad/*buite* ∠ *koordevh*] $\hat{G}_3 = \hat{E}$ [sum∠s Δ OR ext ∠ cyclic quad/*som∠eΔ OR buite∠koordevh*] $\therefore \Delta KGH \parallel\parallel \Delta KEF$ [∠∠∠]	✓ S ✓S ✓R ✓ naming third angle OR ∠∠∠ (4)
10.2.1(b)	$\frac{EF}{GH} = \frac{KE}{KG}$ [||| Δs] $\therefore \frac{EF}{GH} = \frac{KE}{EF}$ [KG = EF] $\therefore EF^2 = KE.GH$	✓ S ✓ S (2)
10.2.1(c)	$\frac{KG}{KF} = \frac{EM}{EF}$ [prop theorem/*eweredighst*; MG | | EK] but EF = KG [given/*gegee*] $\frac{KG}{KF} = \frac{EM}{KG}$ $KG^2 = EM.KF$	✓ S ✓ R ✓ S (3)
10.2.2	KE.GH = EM.KF $EM = \frac{20 \times 4}{16}$ = 5 units	✓ KE.GH = EM.KF ✓ substitution ✓ answer (3) **[19]**

Question 8 **November 2016**

8.1.1	Alternate angles / *verwiss hoeke*, PQ || SR	✓ R (1)
8.1.2(a)	$\hat{T}_2 = 70°$ [∠s opp = sides/∠*e teenoor* = *sye*] $\therefore \hat{Q}_1 = 180° - 2(70°)$ [∠s/*e* Δ = 180°] $= 40°$	✓ S ✓R ✓ answer (3)
8.1.2(b)	$\hat{P}_1 = 40°$ [tangent chord th/*raakl-koordst*]	✓ S ✓R (2)

8.2.1	AT = 20 [line from centre ⊥ to chord/*lyn vanaf midpt ⊥ koord*]	✓S (1)
8.2.2	$AO^2 = OS^2 + AS^2$ [Pyth : ΔAOS] $OT^2 + AT^2 = OS^2 + AS^2$ [Pyth : ΔAOT] But AS = 24 [line from centre ⊥ to chord/*lyn vanaf midpt ⊥ koord*] $OT^2 + 400 = \left(\frac{7}{15}OT\right)^2 + 576$ $176 = \frac{176}{225}OT^2$ $OT^2 = 225$ $OT = 15$ $\therefore AO = \sqrt{225+400}$ $= 25$ **OR/OF** Let OS = 7, then OT = 15 In ΔAOT: $AO^2 = 20^2 + 15^2$ $= 625$ $AO = 25$ In ΔAOS: $AO^2 = 24^2 + 7^2$ $= 625$ $AO = 25$ $\therefore OA = 25$ **OR/OF**	✓ equating ✓ AS = 24 ✓ substitution $OS = \frac{7}{15}OT$ ✓ OT ✓ radius (5) ✓✓ testing in ΔAOT ✓✓ testing in ΔAOS ✓conclusion (5)
	$AO^2 = OS^2 + AS^2$ [Pyth : ΔAOS] $OT^2 + AT^2 = OS^2 + AS^2$ [Pyth : ΔAOT] Let OT = 15x. Then OS = 7x But AS = 24 [line from centre ⊥ to chord/*lyn vanaf midpt ⊥ koord*] $(15x)^2 + 400 = (7x)^2 + 576$ $225x^2 + 400 = 49x^2 + 576$ $176x^2 = 176$ $x = 1$ $\therefore AO = \sqrt{225+400}$ $= 25$ **OR/OF**	✓ equating ✓ AS = 24 ✓ substitution ✓ $x = 1$ ✓ radius (5) ✓ AS = 24

	AS = 24 [line from centre ⊥ to chord/*lyn vanaf midpt ⊥ koord*] $AO^2 = OS^2 + AS^2$ [Pyth : ΔAOS] $= \left(\frac{7}{15}OT\right)^2 + AS^2$ $AO^2 = \frac{49}{225}(AO^2 - 20^2) + 24^2$ [Pyth : ΔAOT] $\frac{176}{225}AO^2 = \frac{4400}{9}$ $AO^2 = 625$ $AO = 25$	✓ substitution $OS = \frac{7}{15}OT$ ✓ equating ✓ subst Pyth ✓ radius (5) **[12]**

Question 9 **November 2016**

9.1.1	tangent chord theorem/*raaklyn-koordstelling*	✓ R (1)
9.1.2	corresponding/*ooreenkomstige* ∠s/*e*; FB ∥ DC	✓ R (1)
9.2	$\hat{E}_1 = B\hat{C}D$ ∴ BCDE = cyclic quad [converse ext ∠ cyc quad/*omgek: buite∠kdvh*]	✓ S ✓ R (2)
9.3	$\hat{D}_2 = \hat{E}_2$ [∠s in the same segment/*∠e in dies segment*] $\hat{D}_2 = F\hat{B}D$ [alt ∠s, BF∥CD/*verwiss ∠e,BF∥CD*]	✓ S ✓ S (2)
9.4	$\hat{B}_3 = y$ *OR* $\hat{B}_3 = \hat{C}_2$ [∠s in the same segment/*∠e in dies segment*] $\hat{B}_2 = x - y$ *OR* $\hat{B}_3 + \hat{B}_2 = x$ [from 9.3 and 9.4] $\hat{C}_1 = x - y$ [from 9.2 and 9.3] $\therefore \hat{B}_2 = \hat{C}_1$ **OR/*OF*** In ΔBFE and ΔBEC $\hat{E}_1 = \hat{E}_2$ [= x] $\hat{F} = \hat{B}_3 + \hat{B}_4$ [tan - chord theorem] ∴ ΔBFE///ΔCBE [∠,∠,∠] $\therefore \hat{B}_2 = \hat{C}_1$	✓ S ✓ S ✓ S (3) ✓ identifying Δ's ✓ S ✓ S (3) **[9]**

Question 10 **November 2016**

10.1	Constr : Join S to R and T to Q and draw h_1 from S $\perp$ PT and h_2 from T $\perp$ PS/ *Verbind SR en TQ en trek h_1 van S $\perp$ PT en h_2 van T $\perp$ PS*]	✓ constr/*konstruksie*
	Proof :	
	$\frac{\text{area } \Delta PST}{\text{area } \Delta QST} = \frac{\frac{1}{2} PS \times h_2}{\frac{1}{2} SQ \times h_2} = \frac{PS}{SQ}$ equal altitudes	✓ $\frac{\text{area } \Delta PST}{\text{area } \Delta QST} = \frac{\frac{1}{2} PS \times h_2}{\frac{1}{2} SQ \times h_2}$
	$\frac{\text{area } \Delta PST}{\text{area } \Delta STR} = \frac{\frac{1}{2} PT \times h_1}{\frac{1}{2} TR \times h_1} = \frac{PT}{TR}$ equal altitudes	✓ $\frac{\text{area } \Delta PST}{\text{area } \Delta STR} = \frac{PT}{TR}$
	area ΔPST = area ΔPST [common]	
	But area ΔQST = area ΔSTR [same base, height; ST || QR]	✓ S ✓ R
	$\therefore \frac{\text{area } \Delta PST}{\text{area } \Delta QST} = \frac{\text{area } \Delta PST}{\text{area } \Delta STR}$	✓ S
	$\therefore \frac{PS}{SQ} = \frac{PT}{TR}$	(6)

10.2.1	Corresponding/*Ooreenkomstige* $\angle$s/*e*; GF || LK	✓ R (1)
10.2.2(a)	$\frac{GL}{LM} = \frac{FK}{KM}$ OR $\frac{GL}{y} = \frac{2x}{x}$ [prop theorem/*eweredighst*; GF || LK]	✓S ✓ R
	$\frac{2GH}{y} = \frac{2x}{x}$ [LH = HG]	✓ GL = 2GH
	$\therefore$ GH = y	(3)

10.2.2(b)	$\hat{K}_1 = G\hat{F}M$ $L\hat{K}M$ or $\hat{K}_1 = M\hat{H}F$ $M\hat{H}F = G\hat{F}M$ In ΔMFH and ΔMGF: $\hat{M} = \hat{M}$ $M\hat{H}F = G\hat{F}M$ $\therefore \Delta MFH \mid\mid\mid \Delta MGF$ **OR/*OR*** $\hat{K}_1 = G\hat{F}M$ $L\hat{K}M$ or $\hat{K}_1 = M\hat{H}F$ $M\hat{H}F = G\hat{F}M$ In ΔMFH and ΔMGF: $\hat{M} = \hat{M}$ $M\hat{H}F = G\hat{F}M$ $\hat{F}_2 = \hat{G}$ $\therefore \Delta MFH \mid\mid\mid \Delta MGF$	[corresponding/*ooreenkomst* ∠s; GF ‖ LK] [ext ∠ cyclic quad/*buite∠koordevh*] [common/*gemeen*] [proven/*bewys*] [∠∠∠] [corresponding/*ooreenkomst* ∠s; GF ‖ LK] [ext ∠ cyclic quad/*buite∠koordevh*] [common/*gemeen*] [proven/*bewys*] [∠s of Δ = 180°]	✓S ✓R ✓S ✓S ✓R (5) ✓S ✓R ✓S ✓S ✓S (5)
10.2.2(c)	$\therefore \frac{GF}{FH} = \frac{MF}{MH}$ $= \frac{3x}{2y}$	[‖| Δs]	✓S ✓R (2)
10.2.3	$\frac{MF}{MH} = \frac{MG}{MF}$ $\frac{3x}{2y} = \frac{3y}{3x}$ $\frac{y^2}{x^2} = \frac{9}{6} = \frac{3}{2}$ $\frac{y}{x} = \sqrt{\frac{3}{2}}$	[‖| Δs] [from 10.2.2(*c*)]	✓S ✓substitution ✓simplification (3) **[20]**