SA-STUDENT

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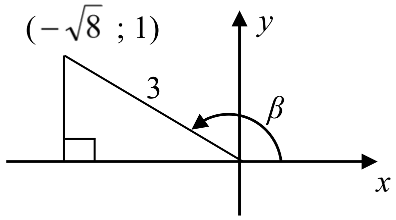
QUESTION/VRAAG 5

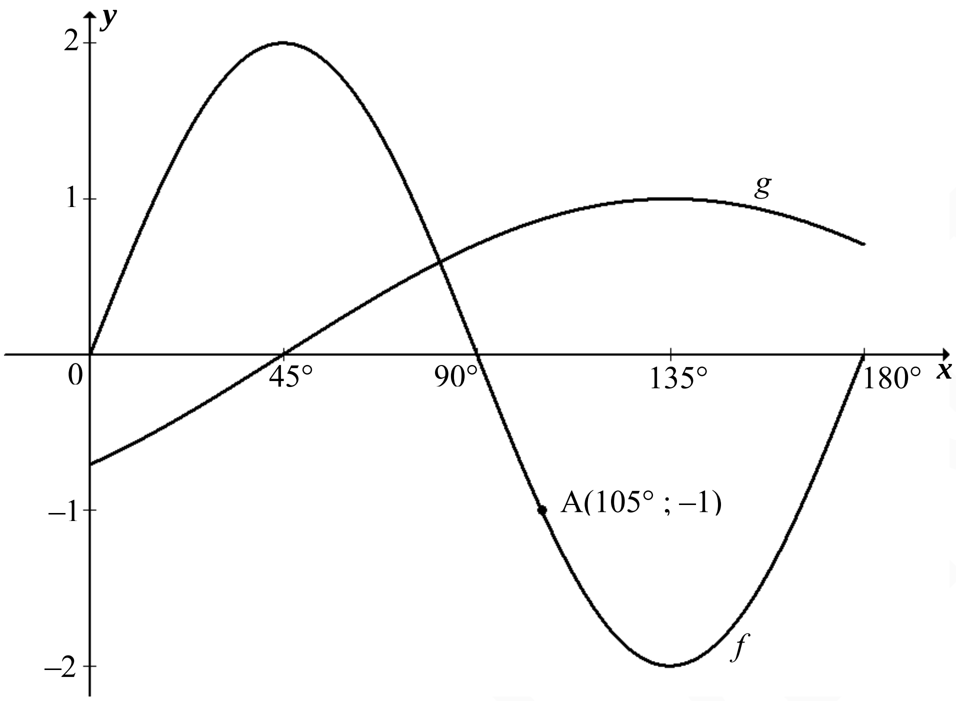
5.1.1	$\sin\beta = \frac{1}{3}$ $\beta \in (90°;270°)$  $x = -\sqrt{8} = -2\sqrt{2}$ $\cos\beta$ $= \frac{-2\sqrt{2}}{3}$ **OR** $\sin\beta = \frac{1}{3}$ $\beta \in (90°;270°)$ $\cos^2\beta = 1 - \sin^2\beta$ $\cos^2\beta = 1 - \left(\frac{1}{3}\right)^2$ $\cos^2\beta = \frac{8}{9}$ $\cos\beta = \frac{-\sqrt{8}}{3}$ $= \frac{-2\sqrt{2}}{3}$	✓ $x^2 + y^2 = r^2$ ✓ $x = -2\sqrt{2}$ ✓ answer (3) ✓ square identity ✓ $\cos^2\beta$ ✓ answer (3)
5.1.2	$\sin 2\beta$ $= 2\sin\beta\cos\beta$ $= 2\left(\frac{1}{3}\right)\left(\frac{-\sqrt{8}}{3}\right)$ $= \frac{-2\sqrt{8}}{9}$ **OR** $2\left(\frac{-2\sqrt{2}}{9}\right)$ $= \frac{-4\sqrt{2}}{9}$	✓ double angle ✓ substitution ✓ answer (3)
5.1.3	$\cos(450° - \beta)$ $= \cos(90° - \beta)$ $= \sin\beta$ $= \frac{1}{3}$ **OR**	✓ $\cos(90° - \beta)$ ✓ co-ratio ✓ answer (3)

	$\cos(450° - \beta)$ $= \cos 450° \cos\beta + \sin 450° \sin\beta$ $= \cos 90° \cos\beta + \sin 90° \sin\beta$ $= \sin\beta$ $= \frac{1}{3}$	✓ expansion ✓ reduction ✓ answer (3)
5.2.1	$\text{LHS} = \frac{\cos^4 x + \sin^2 x.\cos^2 x}{1+\sin x}$ $= \frac{\cos^2 x(\cos^2 x + \sin^2 x)}{1+\sin x}$ $= \frac{1-\sin^2 x}{1+\sin x}$ $= \frac{(1-\sin x)(1+\sin x)}{1+\sin x}$ $= 1-\sin x$ $= \text{RHS}$ **OR** $\text{LHS} = \frac{\cos^4 x + \sin^2 x.\cos^2 x}{1+\sin x}$ $= \frac{\cos^4 x + (1-\cos^2 x)\cos^2 x}{1+\sin x}$ $= \frac{\cos^4 x + \cos^2 x - \cos^4 x}{1+\sin x}$ $= \frac{1-\sin^2 x}{1+\sin x}$ $= \frac{(1-\sin x)(1+\sin x)}{1+\sin x}$ $= 1-\sin x$ $= \text{RHS}$ **OR** $\text{RHS} = 1-\sin x$ $= (1-\sin x)\times\frac{1+\sin x}{1+\sin x}$ $= \frac{1-\sin^2 x}{1+\sin x}$ $= \frac{\cos^2 x}{1+\sin x}$ $= \frac{\cos^2 x(\sin^2 x+\cos^2 x)}{1+\sin x}$ $= \frac{\cos^4 x + \cos^2 x.\sin^2 x}{1+\sin x}$ $= \text{LHS}$	✓ factors ✓ $\sin^2 x + \cos^2 x = 1$ ✓ $\cos^2 x = 1-\sin^2 x$ ✓ factors (4) ✓ $\sin^2 x = 1-\cos^2 x$ ✓ expansion ✓ $\cos^2 x = 1-\sin^2 x$ ✓ factors (4) ✓ $\times\frac{1+\sin x}{1+\sin x}$ ✓ product ✓ $1-\sin^2 x = \cos^2 x$ ✓ $1 = \cos^2 x + \sin^2 x$ (4)

5.2.2	$\sin x+1=0$ $\sin x=-1$ ref. $\angle = 90°$ $x = 270°$	✓ $\sin x+1=0$ ✓ $x = 270°$ (2)
5.2.3	$y=\dfrac{\cos^4 x+\sin^2 x.\cos^2 x}{1+\sin x}$ $y=1-\sin x$ $\therefore$ Minimum = 0	✓✓ Minimum = 0 (2)
5.3.1	sin (A – B) $=\cos\left[90°-(\text{A}-\text{B})\right]$ $=\cos\left[(90°-\text{A})-(-\text{B})\right]$ $=\cos(90°-\text{A})\cos(-\text{B})+\sin(90°-\text{A})\sin(-\text{B})$ $=\sin\text{A}\cos\text{B}+\cos\text{A}(-\sin\text{B})$ $=\sin\text{A}\cos\text{B}-\cos\text{A}\sin\text{B}$ **OR** sin (A – B) $=\cos\left[90°-(\text{A}-\text{B})\right]$ $=\cos\left[(90°+\text{B})-\text{A}\right]$ $=\cos(90°+\text{B})\cos\text{A}+\sin(90°+\text{B})\sin\text{A}$ $=-\sin\text{B}\cos\text{A}+\cos\text{B}\sin\text{A}$ $=\sin\text{A}\cos\text{B}-\cos\text{A}\sin\text{B}$	✓ co-ratio ✓ compound angle ✓ reduction (3) ✓ co-ratio ✓ compound angle ✓ reduction (3)
5.3.2	$\sin 48°\cos x-\cos 48°\sin x=\cos 2x$ $\sin(48°-x)=\cos 2x$ $\sin(48°-x)=\sin(90°-2x)$ $48°-x=90°-2x+k.360°$ or $48°-x=180°-(90°-2x)+k.360°$ $x=42°+k.360°$ $-3x=42°+k.360°$ $x=-14°-k.120°$; $k\in Z$ **OR** $\sin 48°\cos x-\cos 48°\sin x=\cos 2x$ $\sin(48°-x)=\cos 2x$ $\cos(90°-48°+x)=\cos 2x$ $\cos(42°+x)=\cos 2x$ $42°+x=2x+k.360°$ or $42°+x=360°-2x+k.360°$ $-x=-42°+k.360°$ $3x=318°+k.360°$ $x=42°-k.360°$ $x=106°+k.120°$; $k\in Z$	✓ compound angle ✓ co-ratio ✓ both equations ✓ general solution ✓ general solution; $k\in Z$ (5) ✓ compound angle ✓ co-ratio ✓ both equations ✓ general solution ✓ general solution; $k\in Z$ (5)

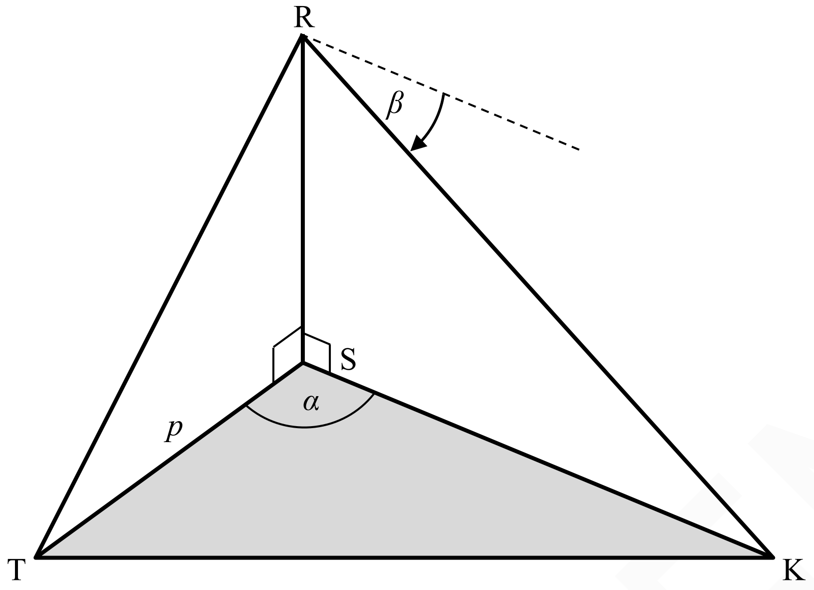
5.4	$\frac{\sin 3x+\sin x}{\cos 2x+1}$ $=\frac{\sin(2x+x)+\sin(2x-x)}{\cos 2x+1}$ $=\frac{\sin 2x\cos x+\cos 2x\sin x+\sin 2x\cos x-\cos 2x\sin x}{2\cos^2 x-1+1}$ $=\frac{2\sin 2x\cos x}{2\cos^2 x}$ $=\frac{2(2\sin x\cos x)\cos x}{2\cos^2 x}$ $=\frac{4\sin x\cos^2 x}{2\cos^2 x}$ $=2\sin x$	✓ $3x=(2x+x)$ ✓ expansion ✓ double angle of cos2x ✓ simplification ✓ $\sin 2x=2\sin x\cos x$ ✓ answer (6)
	OR	
	$\frac{\sin 3x+\sin x}{\cos 2x+1}$ $=\frac{\sin(2x+x)+\sin x}{2\cos^2 x-1+1}$ $=\frac{\sin 2x\cos x+\cos 2x\sin x+\sin x}{2\cos^2 x}$ $=\frac{2\sin x\cos x\cos x+\cos 2x\sin x+\sin x}{2\cos^2 x}$ $=\frac{\sin x(2\cos^2 x+\cos 2x+1)}{2\cos^2 x}$ $=\frac{\sin x(2\cos^2 x+2\cos^2 x-1+1)}{2\cos^2 x}$ $=2\sin x$	✓ $3x=(2x+x)$ ✓ double angle of cos2x ✓ expansion ✓ $\sin 2x=2\sin x\cos x$ ✓ common factor ✓ answer (6)
		[31]

QUESTION/*VRAAG* 6



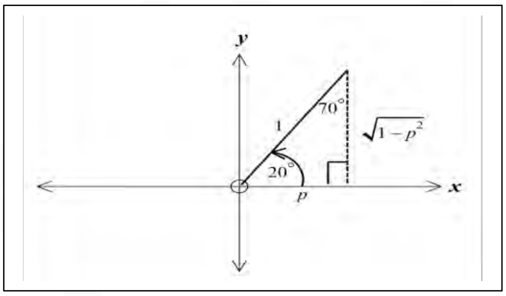
6.1	Period = 180°	✓ 180° (1)
6.2	$y \in \left[-\frac{\sqrt{2}}{2}\ ;1\right]$ **OR** $y \in [-0,71;1]$ **OR** $-\frac{\sqrt{2}}{2} \leq y \leq 1$	✓ $-\frac{\sqrt{2}}{2}$ ✓ $y \in \left[-\frac{\sqrt{2}}{2}\ ;1\right]$ (2)
6.3.1	$x \in (45°\ ;\ 90°)$ **OR** $45° < x < 90°$	✓✓ $x \in (45°\ ;\ 90°)$ (2)
6.3.2	$f(x)+1 \leq 0$ $f(x) \leq -1$ $x \in [105°\ ;\ 165°]$ **OR** $105° \leq x \leq 165°$	✓✓ $x \in [105°\ ;\ 165°]$ (2)
6.4	$p(x) = -2\sin 2x$ $-2\sin 2x = -1$ **OR** $2\sin 2x = 1$ $k = 15°$ or $k = 75°$	✓ reading off $f(x) = 1$ or $-f(x) = -1$ ✓ 15° ✓ 75° (3)
6.5	$g(x) = -\cos(x+45°)$ $h(x) = -\cos(x+90°)$ $h(x) = \sin x$	✓ $-\cos(x+90°)$ ✓ answer (2)
		[12]

QUESTION/*VRAAG* 7



7.1	Area $\Delta STK = \frac{1}{2}p(SK)\sin\alpha$ $q = \frac{1}{2}p(SK)\sin\alpha$ $SK = \frac{q}{\frac{1}{2}p\sin\alpha}$ $= \frac{2q}{p\sin\alpha}$	✓ substitution into the correct formula ✓ answer (2)
7.2	$R\hat{K}S = \beta$ $\frac{RS}{SK} = \tan\beta$ $RS = \frac{2q\tan\beta}{p\sin\alpha}$	✓ $R\hat{K}S = \beta$ ✓ correct trig ratio (2)
	OR $\frac{RS}{\sin\beta} = \frac{SK}{\sin(90° - \beta)}$ $RS\cos\beta = SK\sin\beta$ $RS = SK\tan\beta$ $RS = \frac{2q\tan\beta}{p\sin\alpha}$	✓ $R\hat{K}S = \beta$ ✓ $\tan\beta = \frac{\sin\beta}{\cos\beta}$ (2)
7.3	$70 = \frac{2(2500)\tan 42°}{80\sin\alpha}$ $\sin\alpha = \frac{25}{28}\tan 42°$ **OR** $\sin\alpha = 0,80...$ $\alpha = 53,51°$	✓ correct substitution of values into RS ✓ value of $\sin\alpha$ ✓ answer (3)
		[7]

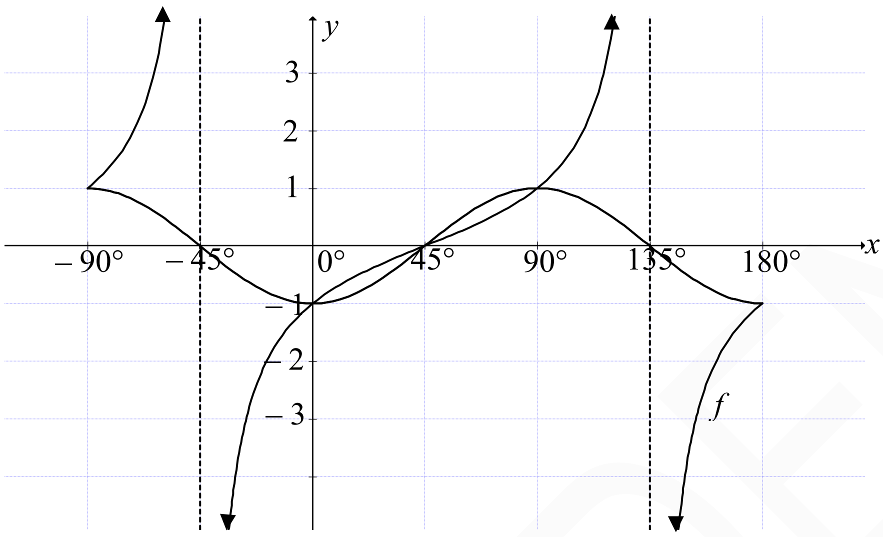
QUESTION/*VRAAG* 5

5.1	$\dfrac{1-\sin(-\theta)\cos(90°+\theta)}{\cos(\theta-360°)}$ $=\dfrac{1-(-\sin\theta)(-\sin\theta)}{\cos\theta}$ $=\dfrac{1-\sin^2\theta}{\cos\theta}$ $=\dfrac{\cos^2\theta}{\cos\theta}$ $=\cos\theta$	✓ $-\sin\theta$ ✓ $-\sin\theta$ ✓ $\cos\theta$ ✓ $\cos^2\theta$ ✓ answer (5)
5.2.1	$\cos 200°$ $=-\cos 20°$ $=-p$	✓ reduction ✓ answer (2)
5.2.2	$\sin(-70°)$ $=-\sin 70°$ $=-\cos 20°$ $=-p$ **OR/*OF*** $\sin(-70°)$ $=-\sin 70°$ $=-p$ 	✓ reduction ✓ answer (2) ✓ reduction ✓ answer (2)
5.2.3	$\sin 10°$ $\cos(2(10°))=1-2\sin^2 10°$ $2\sin^2 10°=1-\cos 20°$ $\sin 10°=\sqrt{\dfrac{1-\cos 20°}{2}}$ $\sin 10°=\sqrt{\dfrac{1-p}{2}}$ **OR/*OF*** $\sin 10°$ $\sin(30°-20°)$ $=\sin 30°\cos 20°-\cos 30°\sin 20°$ $=\dfrac{1}{2}p-\dfrac{\sqrt{3}}{2}\sqrt{1-p^2}=\dfrac{p-\sqrt{3}\sqrt{1-p^2}}{2}$ **OR/*OF***	✓ double angle ✓ $\sin 10°$ as subject ✓ answer (3) ✓ using special angle ✓ expanding ✓ answer (3)

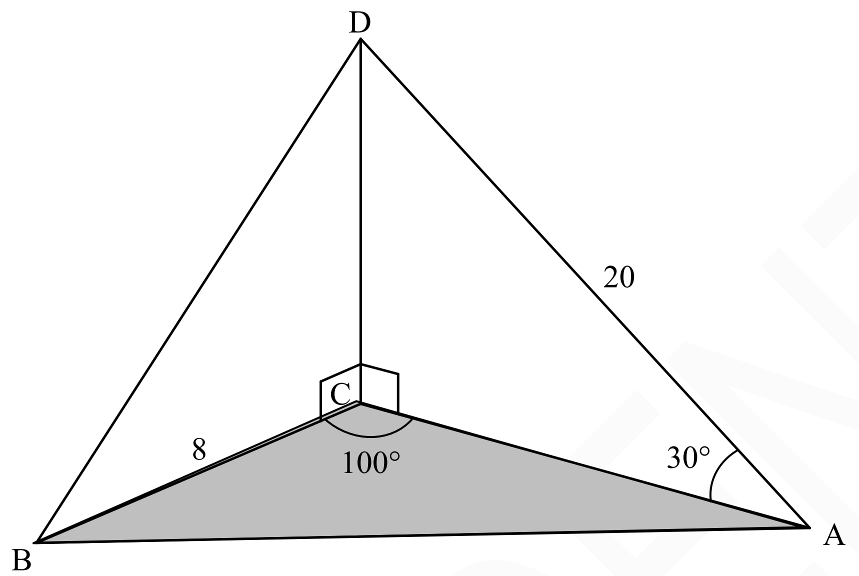
	$\sin 10°$ $\sin(70° - 60°)$ $= \sin 70° \cos 60° - \cos 70° \sin 60°$ $= p.\frac{1}{2} - \sqrt{1-p^2} \times \frac{\sqrt{3}}{2} = \frac{p - \sqrt{3}\sqrt{1-p^2}}{2}$ **OR/*OF*** $\sin 10°$ $= \cos 80°$ $\cos(60° + 20°)$ $= \cos 60° \cos 20° - \sin 60° \sin 20°$ $= \frac{1}{2}p - \frac{\sqrt{3}}{2}.\sqrt{1-p^2}$	✓ using special angle ✓ expanding ✓ answer (3) ✓ using special angle ✓ expanding ✓ answer (3)
5.3	$\cos(A + 55°)\cos(A + 10°) + \sin(A + 55°)\sin(A + 10°)$ $= \cos[A + 55° - (A + 10°)]$ $= \cos 45°$ $= \frac{1}{\sqrt{2}}$ or $\frac{\sqrt{2}}{2}$	✓✓ compound identity ✓ answer (3)
5.4.1	$\text{LHS} = \frac{\cos 2x + \sin 2x - \cos^2 x}{\sin x - 2\cos x}$ $\text{RHS} = -\sin x$ $= \frac{\cos^2 x - \sin^2 x + 2\sin x \cos x - \cos^2 x}{\sin x - 2\cos x}$ $= \frac{-\sin^2 x + 2\sin x \cos x}{\sin x - 2\cos x}$ $= \frac{-\sin x(\sin x - 2\cos x)}{\sin x - 2\cos x}$ $= -\sin x$ $\therefore$ LHS = RHS	✓ $\cos^2 x - \sin^2 x$ ✓ $2\sin x \cos x$ ✓ common factor of $-\sin x$ (3)
5.4.2	$\frac{\cos 2x + \sin 2x - \cos^2 x}{-3\sin^2 x + 6\sin x \cos x}$ $= \frac{\cos 2x + \sin 2x - \cos^2 x}{-3\sin x(\sin x - 2\cos x)}$ $= \frac{\cos 2x + \sin 2x - \cos^2 x}{(\sin x - 2\cos x)} \times \frac{1}{-3\sin x}$ $= (-\sin x) \times \frac{1}{-3\sin x}$ $= \frac{1}{3}$	✓ common factor of $-3\sin x$ ✓ substitution ✓ answer (3)

5.5.1	$3\tan 4x = -2\cos 4x$ $3\left(\dfrac{\sin 4x}{\cos 4x}\right) = -2\cos 4x$ $3\sin 4x + 2\cos^2 4x = 0$ $3\sin 4x + 2(1-\sin^2 4x) = 0$ $-2\sin^2 4x + 3\sin 4x + 2 = 0$ $2\sin^2 4x - 3\sin 4x - 2 = 0$ $(2\sin 4x + 1)(\sin 4x - 2) = 0$ $\sin 4x = -\dfrac{1}{2}$ or $\sin 4x \neq 2$	✓ identity ✓ $1-\sin^2 4x$ ✓ standard form ✓ factors (4)
5.5.2	$\sin 4x = -\dfrac{1}{2}$ *ref.* $\angle = 30°$ $4x = 210° + k.360°$ or $4x = 330° + k.360°$ $x = 52{,}5° + k.90°$; $k \in Z$ $x = 82{,}5° + k.90°$; $k \in Z$	✓ 210° ; 330° ✓ 52,5° ; 82,5° ✓ $k.90°$; $k \in Z$ (3)
		[28]

QUESTION/VRAAG 6

6.1	Period = 180°	✓ answer (1)
6.2		✓ x-intercepts ✓ turning points ✓ end points (3)
6.3	$y \in [-1;1]$ **OR/*OF*** $-1 \le y \le 1$	✓ answer (1)
6.4	$g(x) = -\cos 2x$ $g(x+45°) = -\cos 2(x+45°)$ $= -\cos(2x+90°)$ $= \sin 2x$	✓ $-\cos 2(x+45°)$ ✓ answer (2)
6.5.1	$x \in (-90°;-45°)$ **OR/*OF*** $-90° < x < -45°$	✓✓ $x \in (-90°;-45°)$ (2)
6.5.2	$2\cos 2x - 1 > 0$ $\cos 2x > \frac{1}{2}$ $-\cos 2x < -\frac{1}{2}$ $x \in (-30°;30°)$ **OR/*OF*** $-30° < x < 30°$	✓ $\cos 2x > \frac{1}{2}$ ✓ $-\cos 2x < -\frac{1}{2}$ ✓ $x = \pm 30°$ ✓ interval (4)
		[13]

QUESTION/*VRAAG* 7



7.1.1	$\frac{AC}{20} = \cos 30°$ $AC = 20\cos 30°$ $AC = 10\sqrt{3} = 17{,}32$ units **OR/*OF*** $\frac{AC}{\sin 60°} = \frac{20}{\sin 90°}$ $\therefore AC = 20\sin 60 = 17{,}32$	✓ trig ratio ✓ answer (2) ✓ trig ratio ✓ answer (2)
7.1.2	$AB^2 = AC^2 + BC^2 - 2AC.BC\cos A\hat{C}B$ $AB^2 = (10\sqrt{3})^2 + 8^2 - 2(10\sqrt{3})(8)\cos 100°$ $AB = 20{,}30$ units	✓ cosine formula ✓ substitution into cosine formula ✓ answer (3)
7.2	$\frac{\sin A\hat{D}B}{AB} = \frac{\sin A\hat{B}D}{AD}$ $\frac{\sin A\hat{D}B}{20{,}3} = \frac{\sin 73{,}4°}{20}$ $\sin A\hat{D}B = \frac{20{,}3\sin 73{,}4°}{20}$ $A\hat{D}B = 76{,}58°$	✓ sine formula in ΔABD ✓ substitution into sine formula ✓ answer (3)
		[8]

QUESTION/*VRAAG* 5

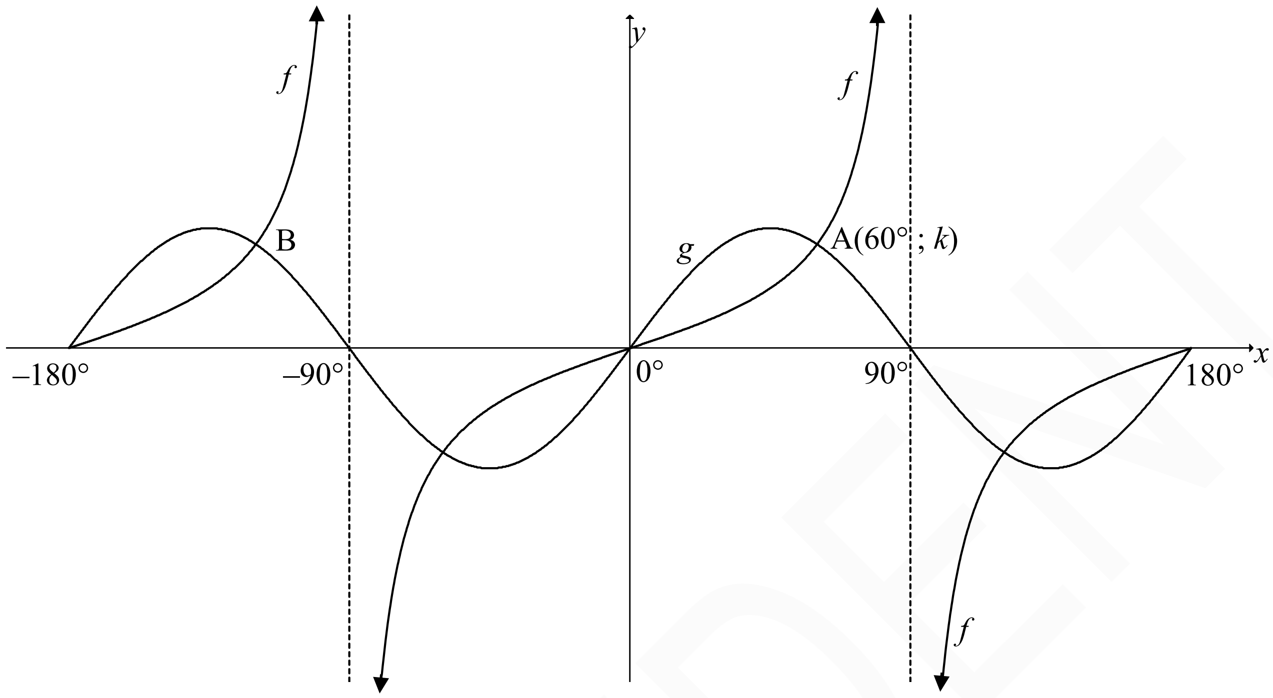
5.1.1	$\sin(360°+x)$ $=\sin x$	✓ + ✓ sin x (2)
5.1.2	$x-\text{coordinate}=\sqrt{\left(\sqrt{13}\right)^2-(-3)^2}$ $=-2$ $\tan x=\frac{-3}{-2}$ $=\frac{3}{2}$ **OR/*OF*** $x-\text{coordinate}=\sqrt{\left(\sqrt{13}\right)^2-(3)^2}$ $=2$ $\tan x=\frac{3}{2}$	✓✓ substitution ✓ method (3) ✓✓ substitution ✓ method (3)
5.1.3	$\cos(180°+x)$ $=-\cos x$	✓ – ✓ cos x (2)
5.2	$\frac{\cos(90°+\theta)}{\sin(\theta-180°)+3\sin(-\theta)}$ $=\frac{-\sin\theta}{\sin(-(180°-\theta))-3\sin\theta}$ $=\frac{-\sin\theta}{-\sin\theta-3\sin\theta}$ $=\frac{-\sin\theta}{-4\sin\theta}$ $=\frac{1}{4}$	✓ $-\sin\theta$ ✓ $-3\sin\theta$ ✓ $-\sin\theta$ ✓ simplification ✓ answer (5)

5.3	$(\cos x + 2\sin x)(3\sin 2x - 1) = 0$ $\cos x + 2\sin x = 0$ or $3\sin 2x - 1 = 0$ $\tan x = -\frac{1}{2}$; $\sin 2x = \frac{1}{3}$ ref $\angle$=26,565...° ; ref $\angle$=19,471...° $x = 153{,}43° + k.180°$; $k \in Z$; $x = 9{,}74° + k.180°$; $k \in Z$ **OR/*OF*** ; or $x = 153{,}43° + k.360°$; $k \in Z$; $x = 80{,}26° + k.180°$; $k \in Z$ or $x = 333{,}43° + k.360°$; $k \in Z$	✓ both equations ✓ $\tan x = -\frac{1}{2}$ ✓ $\sin 2x = \frac{1}{3}$ ✓ $x = 153{,}43°$ **OR** $x = 153{,}43°$ &333,43° ✓ $x = 9{,}74°$ & 80,26° ✓ $+ k.180°$; $k \in$ Z (6)
5.4.1	LHS $=\cos(x+y).\cos(x-y)$ $=[\cos x.\cos y - \sin x.\sin y][\cos x.\cos y + \sin x.\sin y]$ $= \cos^2 x.\cos^2 y - \sin^2 x.\sin^2 y$ $=(1-\sin^2 x)(1-\sin^2 y) - \sin^2 x.\sin^2 y$ $=1+\sin^2 x.\sin^2 y - \sin^2 x - \sin^2 y - \sin^2 x.\sin^2 y$ $=1-\sin^2 x - \sin^2 y$ = RHS	✓ expansion ✓ simplification ✓ square identity ✓ product (4)
5.4.2	$1-\sin^2 45° - \sin^2 15°$ $= \cos(45°+15°).\cos(45°-15°)$ $= \cos 60°.\cos 30°$ $= \left(\frac{1}{2}\right)\left(\frac{\sqrt{3}}{2}\right)$ $= \frac{\sqrt{3}}{4}$ **OR/*OF***	✓ identifying x and y ✓ substitution ✓ answer (3)

	$1-\sin^2 45°-\sin^2 15°$ $=\sin^2 15°+\cos^2 15°-\sin^2 45°-\sin^2 15°$ $=\cos^2 15°-\left(\frac{\sqrt{2}}{2}\right)^2$ $=\cos^2 15°-\frac{1}{2}$ $=\frac{2\cos^2 15°-1}{2}$ $=\frac{\cos 30°}{2}$ $=\frac{\sqrt{3}}{2}\times\frac{1}{2}$ $=\frac{\sqrt{3}}{4}$	✓ identity ✓ substitution ✓ answer (3)
	OR $1-\sin^2 45°-\sin^2 15°$ $=\cos^2 45°-\sin^2(45°-30°)$ $=\left(\frac{1}{\sqrt{2}}\right)^2-(\sin 45°\cos 30°-\cos 45°\sin 30°)^2$ $=\frac{1}{2}-\left(\frac{1}{\sqrt{2}}\times\frac{\sqrt{3}}{2}-\frac{1}{\sqrt{2}}\times\frac{1}{2}\right)^2$ $=\frac{1}{2}-\left(\frac{\sqrt{3}}{2\sqrt{2}}-\frac{1}{2\sqrt{2}}\right)^2$ $=\frac{1}{2}-\left(\frac{\sqrt{3}}{2\sqrt{2}}-\frac{1}{2\sqrt{2}}\right)^2$ $=\frac{1}{2}-\left(\frac{3}{8}-\frac{\sqrt{3}}{4}+\frac{1}{8}\right)$ $=\frac{\sqrt{3}}{4}$	✓ expansion ✓ substitution ✓ answer (3)

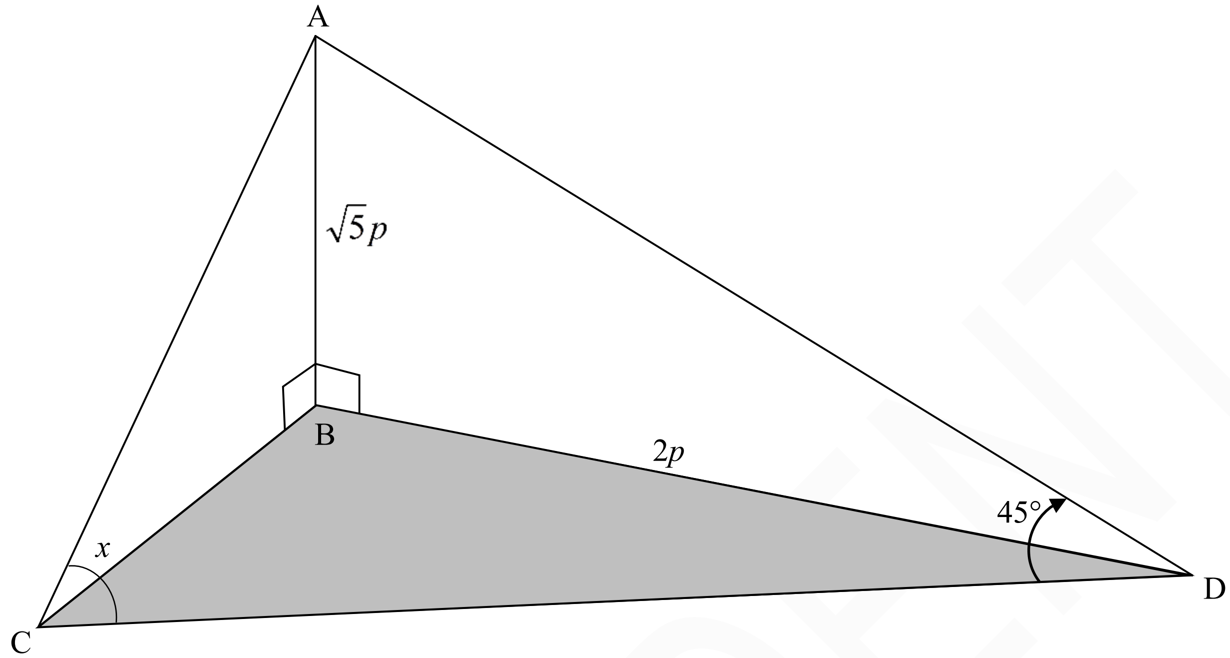
5.5.1	$16\sin x.\cos^3 x - 8\sin x.\cos x$ $= 8\sin x.\cos x(2\cos^2 x - 1)$ $= 4\sin 2x(\cos 2x)$ $= 2\sin 4x$ **OR/*OF*** $16\sin x.\cos^3 x - 8\sin x.\cos x$ $= 16\cos^2 x\left(\frac{1}{2}\sin 2x\right) - 8\left(\frac{1}{2}\sin 2x\right)$ $= 8(2\cos^2 x - 1)\left(\frac{1}{2}\sin 2x\right)$ $= 4\sin 2x.\cos 2x$ $= 2\sin 4x$	✓ factorisation ✓ 4sin2x ✓ cos2x ✓ double angle (4) ✓ factorisation ✓ $4\sin 2x$ ✓ cos2x ✓ double angle (4)
5.5.2	$16\sin x.\cos^3 x - 8\sin x.\cos x = 2\sin 4x$ Minimum at $x = 67{,}5°$	✓ answer (1)
		[30]

QUESTION/*VRAAG* 6



6.1	180°	✓ answer (1)
6.2.1	$k=\sqrt{3}=1,73$	✓ answer (1)
6.2.2	$B(-120°;\sqrt{3})$	✓ $x=-120°$ (1)
6.3	Range of g: $y\in[-2;\ 2]$ Range of $2g(x)$: $y\in[-4;\ 4]$ **OR/*OF*** ANSWER ONLY: Full marks Range of g: $-2\le y\le 2$ Range of $2g(x)$: $-4\le y\ \le 4$	✓ $y\in[-2;\ 2]$ ✓ answer (2) ✓ $-2\le y\le 2$ ✓ answer (2)
6.4	$x\in[-65°;\ -5°]$ **OR/*OF*** $-65°\le x\ \le -5°$	✓✓ $x\in[-65°;\ -5°]$ (2) ✓✓ $-65°\le x\le -5°$ (2)
6.5	$\sin x.\cos x=p$ $4\sin x.\cos x=4p$ $2\sin 2x=4p$ $4p\ =\pm 2$ $\therefore\ p\ =-\frac{1}{2}$ or $\frac{1}{2}$ ANSWER ONLY: Full marks	✓ $2\sin 2x=4p$ ✓ $4p\ =\pm 2$ ✓ answers (3)
		[10]

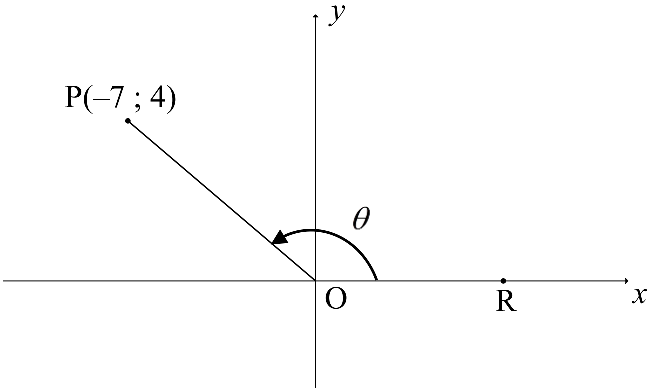
QUESTION/*VRAAG* 7



7.1	$AD^2 = AB^2 + BD^2$ $AD^2 = (\sqrt{5}p)^2 + (2p)^2$ $AD^2 = 9p^2$ $AD = 3p$	✓ substitution in Pythagoras ✓ answer (2)
7.2	$\frac{CD}{\sin(135° - x)} = \frac{3p}{\sin x}$ $CD = \frac{3p\sin(135° - x)}{\sin x}$ $CD = \frac{3p(\sin 135° \cos x - \cos 135° \sin x)}{\sin x}$ $CD = \frac{3p(\sin 45° \cos x + \cos 45° \sin x)}{\sin x}$ $CD = \frac{3p\left(\frac{\sqrt{2}}{2}\cos x + \frac{\sqrt{2}}{2}\sin x\right)}{\sin x}$ $CD = \frac{3p\left(\frac{\sqrt{2}}{2}\right)(\cos x + \sin x)}{\sin x}$ $CD = \frac{3p(\sin x + \cos x)}{\sqrt{2}\sin x}$	✓ correct use of sine rule ✓ $135° - x$ ✓ compound angle ✓ special values ✓ factorisation (5)

7.3	$\text{Area } \Delta \text{ADC} = \frac{1}{2}(\text{AD})(\text{CD})\sin \hat{\text{ADC}}$ $= \frac{1}{2}(3p)\left(\frac{3p(\sin x + \cos x)}{\sqrt{2}\sin x}\right)(\sin 45°)$ $= \frac{1}{2}(30)\left(\frac{30(\sin 110° + \cos 110°)}{\sqrt{2}\sin 110°}\right)\sin 45°$ $= 143{,}11 m^2$	✓ correct use of area rule ✓ substitution in area rule ✓ answer (3)
		[10]

QUESTION/*VRAAG* 5



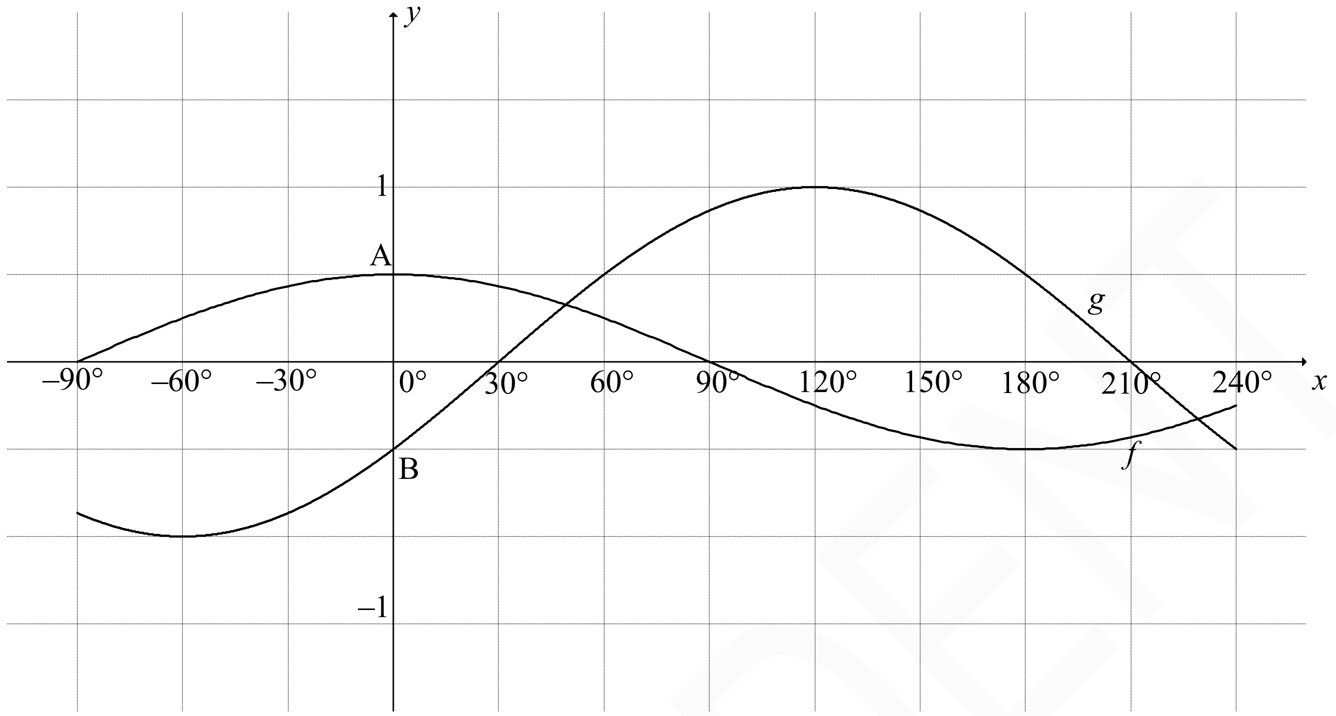
5.1.1	$OP=\sqrt{(-7)^2+(4)^2}$ $=\sqrt{65}$ Answer only 2/2	✓ substitution ✓ answer (2)
5.1.2(a)	$\tan\theta=\dfrac{4}{-7}$	✓ answer (1)
5.1.2(b)	$\cos(\theta-180°)=-\cos\theta$ $=\dfrac{7}{\sqrt{65}}$	✓ reduction ✓ answer (2)
5.2	$\sin x\cos x+\sin x=3\cos^2 x+3\cos x$ $\sin x\cos x+\sin x-3\cos^2 x-3\cos x=0$ $\sin x(\cos x+1)-3\cos x(\cos x+1)=0$ $(\cos x+1)(\sin x-3\cos x)=0$ $\cos x=-1$ or $\sin x=3\cos x$ $\tan x=3$ $x=180°+k.360°$ or $x=71,57°+k.180°$; $k\in Z$ **OR/*OF*** $\sin x\cos x+\sin x=3\cos^2 x+3\cos x$ $\sin x\cos x+\sin x-3\cos^2 x-3\cos x=0$ $\sin x(\cos x+1)-3\cos x(\cos x+1)=0$ $(\cos x+1)(\sin x-3\cos x)=0$ $\cos x=-1$ or $\sin x=3\cos x$ $\tan x=3$ $x=180°+k.360°$ or $x=71,57°+k.360°$ or $x=251,57°+k.360°$; $k\in Z$	✓ RHS = 0 ✓ grouping ✓ factors ✓ both equations ✓ $x=180°$ ✓ $x=71,57°$ ✓ $+k.180°$; $k\in Z$ (7) ✓ RHS = 0 ✓ grouping ✓ factors ✓ both equations ✓ $x=180°$ ✓ $x=71,57°$ and $251,57°$ ✓ $+k.360°$; $k\in Z$ (7)

5.3.1	$\text{LHS} = \frac{\sin 3x}{1-\cos 3x} \times \frac{1+\cos 3x}{1+\cos 3x}$ $= \frac{(\sin 3x)(1+\cos 3x)}{(1-\cos 3x)(1+\cos 3x)}$ $= \frac{(\sin 3x)(1+\cos 3x)}{1-\cos^2 3x}$ $= \frac{(\sin 3x)(1+\cos 3x)}{\sin^2 3x}$ $= \frac{1+\cos 3x}{\sin 3x}$ $= \text{RHS}$	✓ multiply by "1" ✓ $1-\cos^2 3x$ ✓ square identity (3)
	OR/*OF*	
	$\text{LHS} = \frac{\sin 3x}{1-\cos 3x} \times \frac{\sin 3x}{\sin 3x}$ $= \frac{\sin^2 3x}{\sin 3x(1-\cos 3x)}$ $= \frac{1-\cos^2 3x}{\sin 3x(1-\cos 3x)}$ $= \frac{(1-\cos 3x)(1+\cos 3x)}{\sin 3x(1-\cos 3x)}$ $= \frac{1+\cos 3x}{\sin 3x}$ $= \text{RHS}$	✓ multiply by "1" ✓ square identity ✓ factors (3)
5.3.2	undefined when $\sin 3x = 0$ and $1-\cos 3x = 0$ $3x = 0°$ or $3x = 180°$ and $3x = 0°$ or $3x = 360°$ $x = 0°$ or $x = 60°$	✓ $\sin 3x = 0$ and $1-\cos 3x = 0$ ✓ 0° ✓ 60° (3)
		[18]

QUESTION/*VRAAG* 6

6.1	$\frac{\sin 10°}{\cos 440°} + \tan(360° - \theta).\sin 2\theta$ $= \frac{\cos 80°}{\cos 80°} - \tan\theta(2\sin\theta\cos\theta)$ $= 1 - \frac{\sin\theta}{\cos\theta}(2\sin\theta\cos\theta)$ $= 1 - 2\sin^2\theta$ $= \cos 2\theta$	✓ $-\tan\theta$ ✓ cos 80° ✓ co-ratio ✓ double angle ✓ quotient identity ✓ answer (6)
6.2.1	$\sin(60° + 2x) + \sin(60° - 2x) = k\cos 2x$ $(\sin 60°\cos 2x + \cos 60°\sin 2x) + (\sin 60°\cos 2x - \cos 60°\sin 2x) = k\cos 2x$ $2\sin 60°\cos 2x = k\cos 2x$ $2\left(\frac{\sqrt{3}}{2}\right)\cos 2x = k\cos 2x$ $\therefore k = \sqrt{3}$	✓ both expansions correct ✓ special ∠s ✓ answer (3)
6.2.2	$\tan 60°[\sin(60° + 2x) + \sin(60° - 2x)]$ $= \tan 60°[k\cos 2x]$ $= \sqrt{3}(\sqrt{3}\cos 2x)$ $= 3(2\cos^2 x - 1)$ $= 3\left(2\left(\sqrt{t}\right)^2 - 1\right)$ $= 6\left(\sqrt{t}\right)^2 - 3$ $= 6t - 3$	✓ special ∠ ✓ double ∠s ✓ answer i.t.o t (3)
		[12]

QUESTION/*VRAAG* 7



7.1	$A\left(0;\frac{1}{2}\right)$ $B\left(0;-\frac{1}{2}\right)$ $AB=\frac{1}{2}-\left(-\frac{1}{2}\right)$ $= 1$ unit Answer only 2/2	✓ *y*-values ✓ answer (2)
7.2	Range of f : $y\in\left[-\frac{1}{2};\frac{1}{2}\right]$ Range of $3f(x)+2$: $y\in\left[\frac{1}{2};3\frac{1}{2}\right]$ **OR/*OF*** $\frac{1}{2}\le y\le 3\frac{1}{2}$	✓ critical values ✓ answer (2)
7.3	$x=90°$	✓✓ $x=90°$ (2)
7.4.1	$x\in(30°;90°)\cup(210°;240°]$ **OR/*OF*** $30°<x<90°$ or $210°<x\le 240°$	✓ $x\in(30°;90°)$ ✓ $(210°;240°]$ (2) ✓ $30°<x<90°$ ✓ $210°<x\le 240°$ (2)
7.4.2	$x\in(-55°;125°)$ **OR/*OF*** $-55°<x<125°$	✓ critical values ✓ answer (2) ✓ critical values ✓ answer (2)
		[10]

QUESTION/*VRAAG* 8

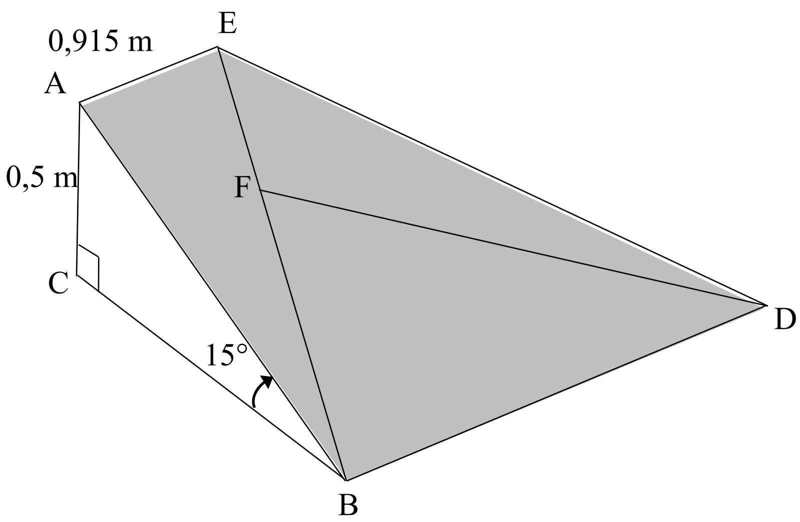


FIGURE I

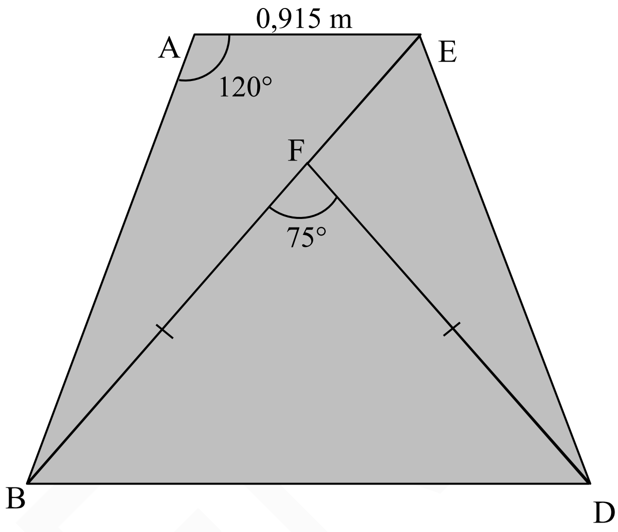
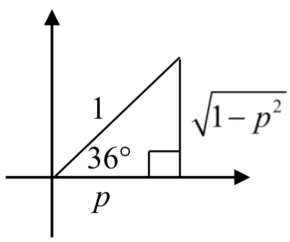


FIGURE II (top view)

8.1	$\frac{0,5}{AB} = \sin 15°$ $AB = \frac{0,5}{\sin 15°}$ $AB = 1,93$ m Answer only 2/2	✓ trig ratio ✓ answer (2)
8.2	$BE^2 = AB^2 + AE^2 - 2(AB)(AE)\cos B\hat{A}E$ $BE^2 = (1,93)^2 + (0,915)^2 - 2(1,93)(0,915)(\cos 120°)$ $BE = 2,52$ m	✓ correct use of cosine rule ✓ substitution ✓ answer (3)
8.3	$BF = FD = \frac{5}{7}(2,52) = 1,80$ m $\text{Area } \Delta BFD = \frac{1}{2}(BF)(FD)\sin B\hat{F}D$ $= \frac{1}{2}(1,8)(1,8)(\sin 75°)$ $= 1,56 \text{ m}^2$	✓ BF ✓ correct substitution into the area rule ✓ answer (3)
		[8]

QUESTION/*VRAAG* 5

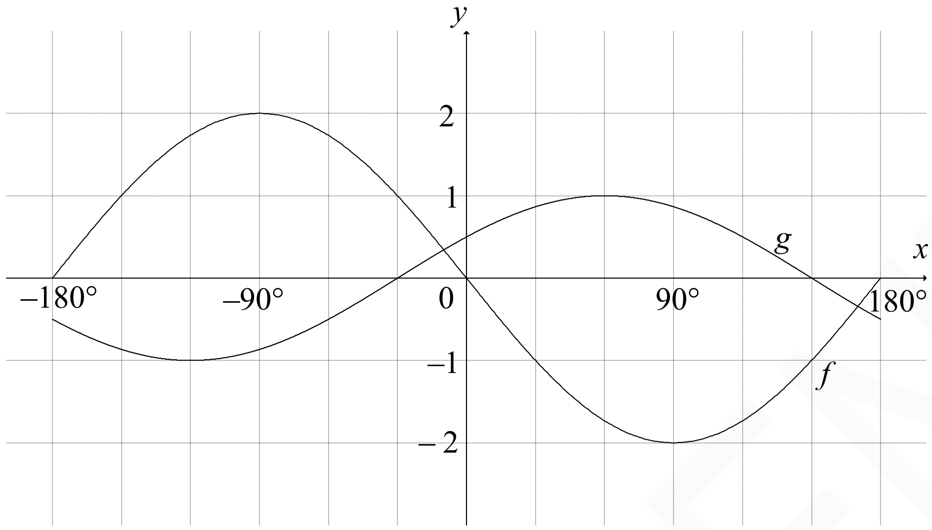
5.1	$\frac{\sin 140°.\sin(360° - x)}{\cos 50°.\tan(-x)}$ $= \frac{\sin 40°(-\sin x)}{\sin 40°(-\tan x)}$ $= \frac{-\sin x}{-\frac{\sin x}{\cos x}}$ $= \cos x$	✓ sin40° ✓ $-\sin x$ ✓ co-ratio ✓ $-\tan x$ ✓ $\tan x = \frac{\sin x}{\cos x}$ ✓ answer (6)
5.2	$\text{LHS} = \frac{-2\sin^2 x + \cos x + 1}{1 - \cos(540° - x)}$ $\text{RHS} = 2\cos x - 1$ $\text{LHS} = \frac{-2(1-\cos^2 x) + \cos x + 1}{1 - (-\cos x)}$ $\text{LHS} = \frac{-2 + 2\cos^2 x + \cos x + 1}{1 + \cos x}$ $\text{LHS} = \frac{2\cos^2 x + \cos x - 1}{1 + \cos x}$ $\text{LHS} = \frac{(2\cos x - 1)(\cos x + 1)}{1 + \cos x}$ $\text{LHS} = 2\cos x - 1$ $\therefore \text{LHS} = \text{RHS}$	✓ identity i. t. o. $\cos x$ ✓ $\cos(540° - x) = -\cos x$ ✓ standard form ✓ factors (4)
5.3.1	$\sin 36° = \sqrt{1 - p^2}$ $\tan 36° = \frac{\sqrt{1-p^2}}{p}$  **OR/*OF*** $\cos^2 36° = 1 - \sin^2 36°$ $\cos 36° = \sqrt{1 - (1 - p^2)}$ $= p$ $\tan 36° = \frac{\sin 36°}{\cos 36°}$ $= \frac{\sqrt{1-p^2}}{p}$	✓ method ✓ value of p ✓ answer (3) ✓ method ✓ cos 36° $= p$ ✓ answer (3)

5.3.2	$\cos 108°$ $= -\cos 72°$ $= -\cos(2\times 36°)$ $= -(2\cos^2 36° - 1)$ $= -2p^2 + 1$	✓ reduction ✓ double angle ✓ expansion ✓ answer i. t. o. p (4)
	OR/*OF* $\cos 108°$ $= -\cos 72°$ $= -\cos(2\times 36°)$ $= -(1 - 2\sin^2 36°)$ $= -1 + 2\left(\sqrt{1-p^2}\right)^2$ $= -1 + 2(1-p^2)$ $= -2p^2 + 1$	✓ reduction ✓ double angle ✓ expansion ✓ answer i. t. o. p (4)
	OR/*OF* $\cos 108°$ $= -\cos 72°$ $= -\cos(2\times 36°)$ $= -(\cos^2 36° - \sin^2 36°)$ $= -\left(p^2 - \left(\sqrt{1-p^2}\right)^2\right)$ $= -\left(p^2 - (1-p^2)\right)$ $= -2p^2 + 1$	✓ reduction ✓ double angle ✓ expansion ✓ answer i. t. o. p (4)
	OR/*OF* $\cos 108°$ $= \cos(2\times 54°)$ $= 2\cos^2 54° - 1$ $= 2(1-p^2) - 1$ $= 1 - 2p^2$	✓ double angle ✓✓ expansion ✓ answer i. t. o. p (4)
	OR/*OF* $\cos 108° = \cos(72° + 36°)$ $= \cos 72° \cos 36° - \sin 72° \sin 36°$ $= (2\cos^2 36° - 1)\cos 36° - (2\sin 36° \cos 36°)\sin 36°$ $= 2\cos^3 36° - \cos 36° - 2\cos 36° \sin^2 36°$ $= 2p^3 - p - 2p\left(\sqrt{1-p^2}\right)^2$ $= 2p^3 - p - 2p + 2p^3$ $= 4p^3 - 3p$	✓ expansion ✓ both double angle identities ✓ value of sin 36° ✓ answer i. t. o. p (4)
		[17]

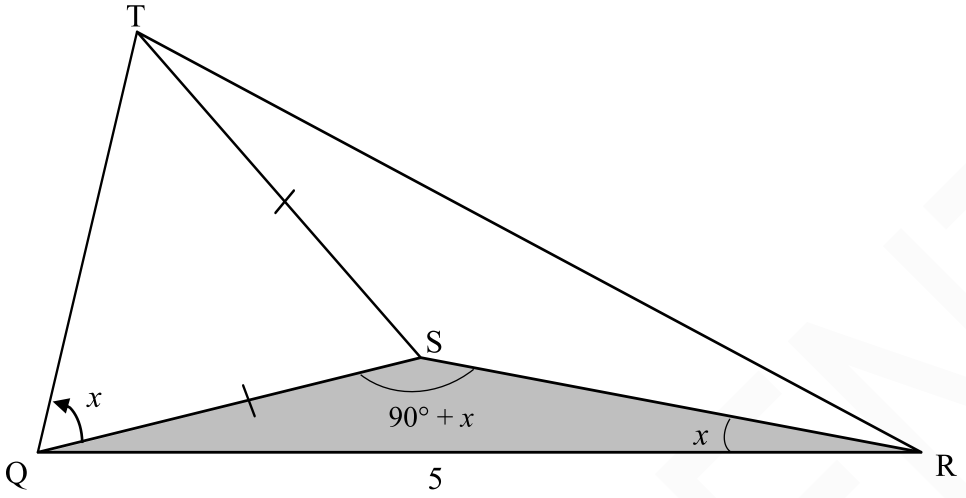
QUESTION/*VRAAG* 6

6.1.1	$\cos(\alpha+\beta)$ $=\cos(\alpha-(-\beta))$ $=\cos\alpha\cos(-\beta)+\sin\alpha\sin(-\beta)$ $=\cos\alpha\cos\beta+\sin\alpha(-\sin\beta)$ $=\cos\alpha\cos\beta-\sin\alpha\sin\beta$	✓ $\cos(\alpha-(-\beta))$ ✓ expansion ✓ reduction (3)
6.1.2	$2\cos 6x\cos 4x-\cos 10x+2\sin^2 x$ $=2\cos 6x\cos 4x-\cos(6x+4x)+2\sin^2 x$ $=2\cos 6x\cos 4x-(\cos 6x\cos 4x-\sin 6x\sin 4x)+2\sin^2 x$ $=\cos 6x\cos 4x+\sin 6x\sin 4x+2\sin^2 x$ $=\cos 2x+2\sin^2 x$ $=1-2\sin^2 x+2\sin^2 x$ $=1$	✓ $\cos 10x=\cos(6x+4x)$ ✓ expansion of $\cos(6x+4x)$ ✓ $\cos 2x$ ✓ $1-2\sin^2 x$ ✓ answer (5)
6.2	$\tan x=2\sin 2x$ $\frac{\sin x}{\cos x}=2(2\sin x\cos x)$ $\sin x=4\sin x\cos^2 x$ $4\sin x\cos^2 x-\sin x=0$ $\sin x(4\cos^2 x-1)=0$ $\sin x=0$ or $\cos^2 x=\frac{1}{4}$ $\cos x=-\frac{1}{2}$ $x=180°+k.360°;\ k\in Z$ or $x=120°+k.360°;\ k\in Z$ $x=240°+k.360°;\ k\in Z$ **OR/*OF*** $\tan x=2\sin 2x$ $\frac{\sin x}{\cos x}=4\sin x\cos x$ $\sin x=4\sin x\cos^2 x$ $4\sin x\cos^2 x-\sin x=0$ $4\sin x(1-\sin^2 x)-\sin x=0$ $3\sin x-4\sin^3 x=0$ $\sin x(3-4\sin^2 x)=0$ $\sin x=0$ or $\sin^2 x=\frac{3}{4}$ $\sin x=\frac{\sqrt{3}}{2}$ or $\sin x=-\frac{\sqrt{3}}{2}$ $x=180^\circ+k.360^\circ, k\in Z$ or $x=120^\circ+k.360^\circ, k\in Z$ or $x=240^\circ+k.360^\circ, k\in Z$	✓ quotient identity ✓ double angle identity ✓ factors ✓ both equations ✓ $x=180°$ ✓ $x=120°$& $240°$ **OR/OF** $x=\pm120°$ ✓ $k.360°;\ k\in Z$ (7) ✓ quotient identity ✓ identity ✓ factors ✓ both equations ✓ $x=180°$ ✓ $x=120°$& $240°$ **OR/OF** $x=\pm120°$ ✓ $k.360°;\ k\in Z$ (7)
		[15]

QUESTION/*VRAAG* 7

7.1		✓ both turning points ✓ both x intercepts (–30° & 150°) ✓ shape (3)
7.2	Period = 120°	✓✓ answer (2)
7.3	$x = -30°$	✓ answer (1)
7.4	Range of/*waardeversameling van g*: $y \in [-1;1]$ Range of/*Waardeversameling van* $\frac{1}{2}g$: $y \in \left[-\frac{1}{2};\frac{1}{2}\right]$ Range of/*Waardeversameling van* $\frac{1}{2}g+1$: $y \in \left[\frac{1}{2};\frac{3}{2}\right]$ **OR/*OF*** Range of/*Waardeversameling van* $\frac{1}{2}g+1$: $\frac{1}{2} \leq y \leq \frac{3}{2}$	✓ critical values ✓ correct notation (2) ✓ critical values ✓ correct notation (2)
		[8]

QUESTION/*VRAAG* 8



8.1	In ΔSQR: $\frac{QS}{\sin x} = \frac{QR}{\sin(90° + x)}$ $\frac{QS}{\sin x} = \frac{5}{\cos x}$ $QS = \frac{5\sin x}{\cos x}$ $QS = 5\tan x$	✓ correct use of sine rule ✓ $\sin(90° + x) = \cos x$ ✓ $QS = \frac{5\sin x}{\cos x}$ (3)
8.2	$\frac{QT}{\sin(180° - 2x)} = \frac{TS}{\sin x}$ $\frac{QT}{\sin 2x} = \frac{5\tan x}{\sin x}$ $QT = \frac{5\tan x \sin 2x}{\sin x}$ $QT = \frac{5\left(\frac{\sin x}{\cos x}\right)(2\sin x \cos x)}{\sin x}$ $QT = \frac{5\sin x\,(2\sin x)}{\sin x}$ $QT = 10\sin x$	✓ correct use of sine rule ✓ TS = QS = 5tan$x$ ✓ $QT = \frac{5\tan x \sin 2x}{\sin x}$ ✓ $\tan x = \frac{\sin x}{\cos x}$ ✓ $\sin 2x = 2\sin x \cos x$ (5)

	OR/*OF* $QT^2 = QS^2 + TS^2 - 2QS.TS\cos Q\hat{S}T$ $QT^2 = (5\tan x)^2 + (5\tan x)^2 - 2(5\tan x).(5\tan x)\cos(180° - 2x)$ $QT^2 = 50\tan^2 x - 50\tan^2 x(-\cos 2x)$ $QT^2 = 50\tan^2 x(1+\cos 2x)$ $QT^2 = 50\tan^2 x(1+2\cos^2 x - 1)$ $QT^2 = 50\tan^2 x(2\cos^2 x)$ $QT^2 = 100\dfrac{\sin^2 x}{\cos^2 x}(\cos^2 x)$ $QT^2 = 100\sin^2 x$ $QT = 10\sin x$	✓ correct use of cos rule ✓ TS = QS = 5tan$x$ ✓ $\cos 2x = 2\cos^2 x - 1$ & reduction ✓ $\tan x = \dfrac{\sin x}{\cos x}$ ✓ $QT^2 = 100\sin^2 x$ (5)
	OR/*OF* $TS^2 = QS^2 + TQ^2 - 2QS.TQ.\cos x$ $(5\tan x)^2 = (5\tan x)^2 + TQ^2 - 2(5\tan x).TQ.\cos x$ $0 = TQ^2 - 2(5\tan x).TQ.\cos x$ $0 = TQ[TQ - 10\tan x.\cos x]$ $TQ = 10\tan x.\cos x \quad (TQ \neq 0)$ $= 10\dfrac{\sin x}{\cos x}.\cos x$ $= 10\sin x$	✓ correct use of cos rule ✓ TS = QS = 5tan$x$ ✓ quadratic equation ito TQ ✓ TQ = 10tan x . cos x ✓ $\tan x = \dfrac{\sin x}{\cos x}$ (5)
8.3	Area of $\Delta TQR = \dfrac{1}{2}.TQ.QR\sin T\hat{Q}R$ $= \dfrac{1}{2}(10\sin 25°)(5)(\sin 70°)$ $= 9{,}93\text{ unit}^2$	✓ correct substitution into the area rule ✓ answer (2)
		[10]

QUESTION/VRAAG 5

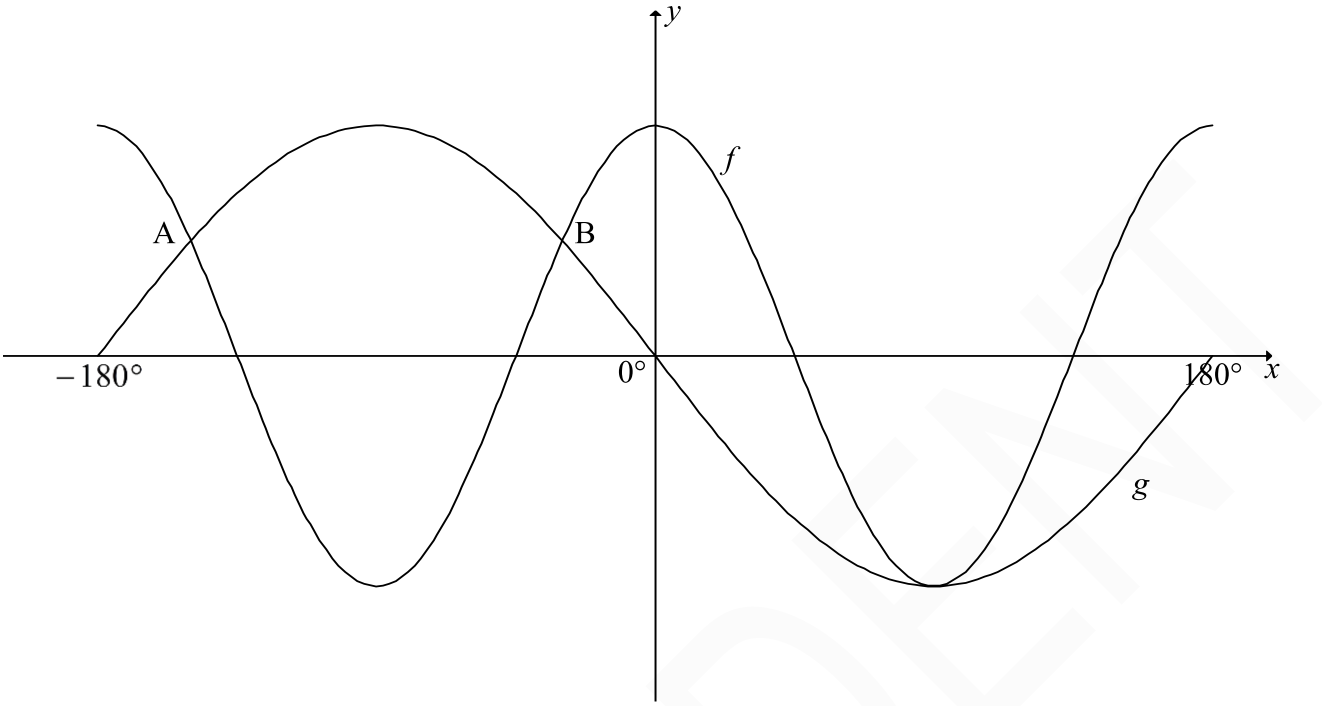
5.1	$\tan(-x).\cos x.\sin(x-180°)-1$ $=-\tan x.\cos x.\sin(-(180°-x))-1$ $=\frac{-\sin x}{\cos x}.\cos x.(-\sin x)-1$ $=\sin^2 x-1$ $=-\cos^2 x$	✓ $-\tan x$ ✓ $-\sin x$ ✓ $\frac{-\sin x}{\cos x}$ ✓ $\sin^2 x-1$ ✓ answer (5)
5.2.1	$\cos 215°$ $=-\cos 35°$ $=-m$	✓ reduction ✓ answer (2)
5.2.2	$\sin 20°$ $=\cos 70°$ $=\cos 2(35°)$ $=2\cos^2 35°-1$ $=2m^2-1$ OR $=\sin(55°-35°)$ $=\sin 55°\cos 35°-\cos 55°\sin 35°$ $=m.m-\sqrt{1-m^2}.\sqrt{1-m^2}$ $=m^2-(1-m^2)$ $=2m^2-1$	✓ co-function ✓ double angle expansion ✓ answer in terms of m (3) ✓ compound angle expansion ✓ $\cos 55°=\sqrt{1-m^2}$ or $\sin 35°=\sqrt{1-m^2}$ ✓ answer in terms of m (3)
5.3	$\cos 4x.\cos x+\sin 4x.\sin x=-0{,}7$ $\cos(4x-x)=-0{,}7$ ref $\angle=45{,}57\ldots°$ $3x=180°-45{,}57\ldots°+k.360°$ or $3x=180°+45{,}57\ldots°+k.360°$ $3x=134{,}43°+k.360°$ or $3x=225{,}57°+k.360°$ $x=44{,}81°+k.120°;\ k\in Z$ $x=75{,}19°+k.120°;\ k\in Z$	✓ compound angle ✓ $3x=134{,}43°$ or $225{,}57°$ ✓ $x=44{,}81°$ or $75{,}19°$ ✓ $+k.120°;\ k\in Z$ (4)

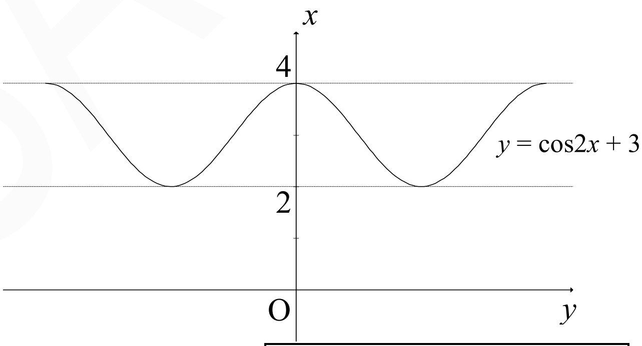
5.4	$\text{RHS} = \cos^2 x - \sin^2 x$ $\text{LHS} = \dfrac{\sin 4x.\cos 2x - 2\cos 4x.\sin x.\cos x}{\tan 2x}$ $= \dfrac{\sin 4x.\cos 2x - \cos 4x.\sin 2x}{\dfrac{\sin 2x}{\cos 2x}}$ $= \sin(4x - 2x)\left(\dfrac{\cos 2x}{\sin 2x}\right)$ $= \cos 2x$ $= \cos^2 x - \sin^2 x$ LHS = RHS	✓ $\sin 2x$ ✓ $\dfrac{\sin 2x}{\cos 2x}$ ✓ $\sin(4x - 2x)$ ✓ $\cos 2x$ (4)
		[18]

QUESTION/VRAAG 6

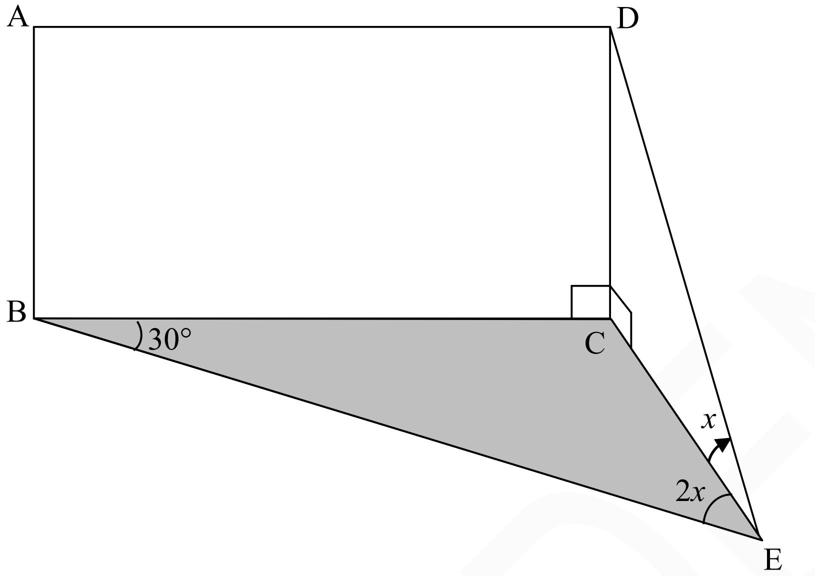
6.1	$1-2\sin^2 x=-\sin x$ $2\sin^2 x-\sin x-1=0$ $(2\sin x+1)(\sin x-1)=0$ $\sin x=-\frac{1}{2}$ or $\sin x=1$ ref $\angle=30°$ ref $\angle=90°$ $x=210°+k.360°$ or $x=330°+k.360°$ $x=90°+k.360°$ $x=-150°$ or $x=-30°$ or $x=90°$	✓ identity ✓ factors ✓ $\sin x=-\frac{1}{2}$ ✓ $\sin x=1$ ✓ –150° and –30° ✓ 90° (A) (6)
	OR	
	$\cos 2x=-\sin x$ $\cos 2x=-\cos(90°-x)$ $2x=180°-(90°-x)+k.360°$ or $2x=180°+(90°-x)+k.360°$ $2x=90°+x+k.360°$ or $2x=270°-x+k.360°$ $x=90°+k.360°$ $x=90°+k.120°$ $x=-150°$ or $x=-30°$ or $x=90°$	✓ co-functions ✓ $2x$ in quadrant 2 ✓ $2x$ in quadrant 3 ✓ both general solutions ✓ –150° and –30° ✓ 90° (A) (6)
	OR	
	$\cos 2x=-\sin x$ $\cos 2x=\cos(90°+x)$ $2x=90°+x+k.360°$ or $2x=360°-(90°+x)+k.360°$ $x=90°+k.360°$ or $3x=270°+k.360°$ $x=90°+k.120°$ $x=-150°$ or $x=-30°$ or $x=90°$	✓ co-functions ✓ $2x$ in quadrant 1 ✓ $2x$ in quadrant 4 ✓ both general solutions ✓ –150° and –30° ✓ 90° (A) (6)
	OR	
	$\cos 2x=-\sin x$ $\sin(90°-2x)=-\sin x$ $90°-2x=180+x+k.360°$ or $90°-2x=360°-x+k.360°$ $x=-30°+k.120°$ $x=-270°+k.360°$ $x=-150°$ or $x=-30°$ or $x=90°$	✓ co-functions ✓ 90°–$2x$ in quadrant 3 ✓ 90°–$2x$ in quadrant 4 ✓ both general solutions ✓ –150° and –30° ✓ 90° (A) (6)

6.2



6.2.1	A(–150°; 0,5) B(–30°; 0,5) AB = –30° – (–150°) AB = 120° Answer only: Full marks	✓ AB = –30° – (–150°) ✓ answer (2)
6.2.2	$x \in (0°; 90°)$ or $x \in (90°; 180°)$ **OR** $0° < x < 90°$ or $90° < x < 180°$	✓ $x \in (0°; 90°)$ ✓ $x \in (90°; 180°)$ (2) ✓ $0° < x < 90°$ ✓ $90° < x < 180°$ (2)
6.2.3	$\cos 2x = k - 3$ $k - 3 < -1$ or $k - 3 > 1$ $k < 2$ or $k > 4$ Answer only: Full marks **OR**  $k < 2$ or $k > 4$ Answer only: Full marks	✓ $k - 3 < -1$ or $k - 3 > 1$ ✓ $k < 2$ ✓ $k > 4$ (3) ✓ graph of $y = \cos 2x + 3$ ✓ $k < 2$ ✓ $k > 4$ (3)
		[13]

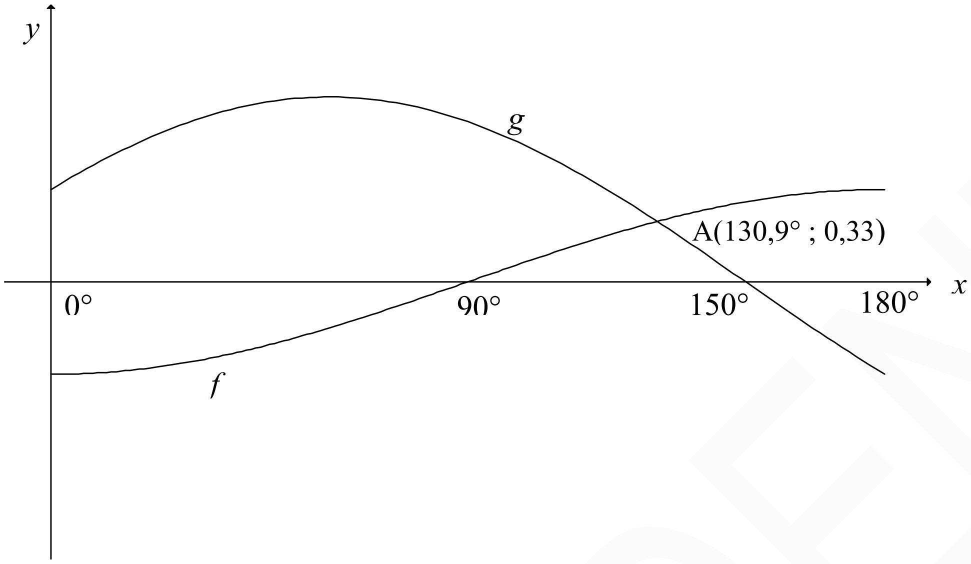
QUESTION/VRAAG 7



7.1	In ΔBCE: $\frac{CE}{\sin\hat{B}} = \frac{BC}{\sin B\hat{E}C}$ $\frac{CE}{\sin 30°} = \frac{BC}{\sin 2x}$ $CE = \frac{BC\sin 30°}{\sin 2x}$ In ΔCDE: $\frac{DC}{CE} = \tan D\hat{E}C$ $DC = \frac{BC.\sin 30°}{\sin 2x}(\tan x)$ $DC = \frac{BC}{4\sin x\cos x}\left(\frac{\sin x}{\cos x}\right)$ $DC = \frac{BC}{4\cos^2 x}$	✓ correct use of sine rule ✓ $CE = \frac{BC\sin 30°}{\sin 2x}$ ✓ correct trig ratio ✓ Subst CE ✓ $2\sin x\cos x$ ✓ $\frac{\sin x}{\cos x}$ (6)

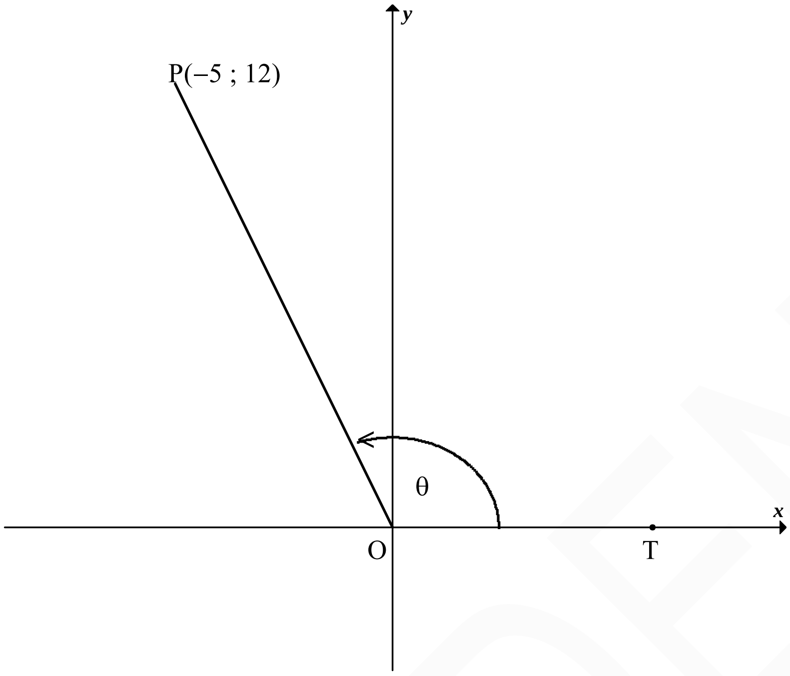
7.2	$DC = \frac{BC}{4\cos^2 30°}$ $= \frac{BC}{4\left(\frac{\sqrt{3}}{2}\right)^2}$ $= \frac{BC}{3}$ $\therefore BC = 3DC$ But AB = DC [opp sides of rectangle/*teenoorst. sye v reghoek*] $\therefore BC = 3AB$ Area of rectangle = (AB)(BC) = (AB)(3AB) $=3AB^2$	✓ $DC == \frac{BC}{3}$ ✓ $BC = 3AB$ ✓ substitution into area formula (3)
		[9]

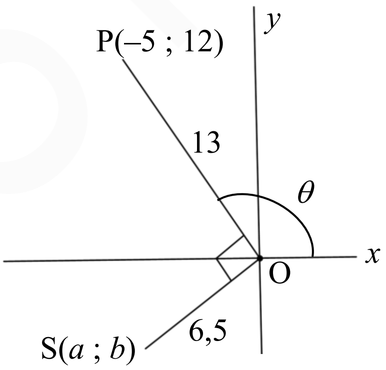
QUESTION/*VRAAG* 5



5.1	Period of $g = 360°$	✓ answer (1)
5.2	Amplitude of $f = \frac{1}{2}$	✓ answer (A) (1)
5.3	$f(180°) - g(180°)$ $= \frac{1}{2} - \left(-\frac{1}{2}\right)$ $= 1$	✓ 1 (1)
5.4.1	$x = 140{,}9°$	✓ $x = 140{,}9°$ (1)
5.4.2	$\sqrt{3}\sin x + \cos x \geq 1$ $\frac{\sqrt{3}}{2}\sin x + \frac{1}{2}\cos x \geq \frac{1}{2}$ $\sin x \cos 30° + \cos x \sin 30° \geq \frac{1}{2}$ $\sin(x + 30°) \geq \frac{1}{2}$ $\sin(x + 30°) = \frac{1}{2}$ at $x = 0°$ or $x = 120°$ $\therefore x \in [0°;120°]$ **OR** $0° \leq x \leq 120°$	✓ dividing by 2 ✓ $\cos 30°; \sin 30°$ ✓ $\sin(x + 30°) \geq \frac{1}{2}$ ✓ interval (4)
		[8]

QUESTION/*VRAAG* 6

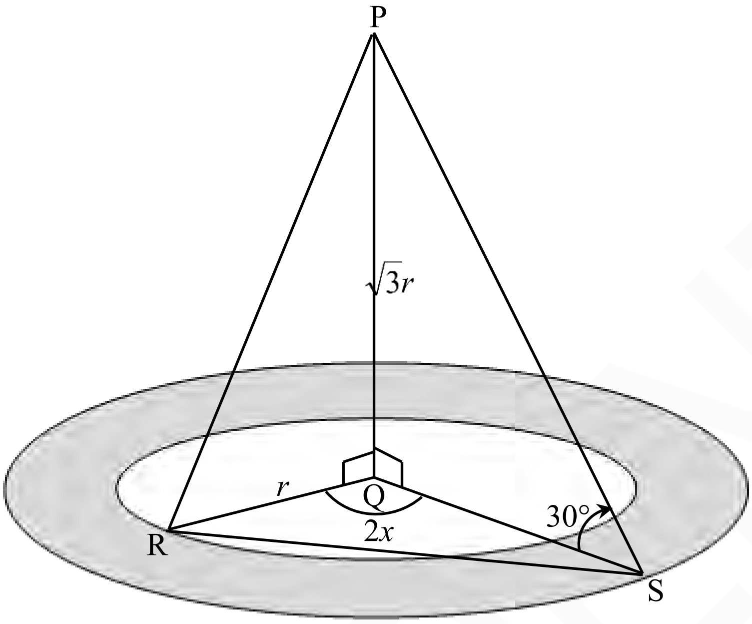


6.1.1	$\tan\theta = -\frac{12}{5}$ or $-2\frac{2}{5}$	✓answer (1)
6.1.2	$(OP)^2 = (-5)^2 + (12)^2$ $OP = 13$ $\cos\theta = -\frac{5}{13}$	✓ Pythagoras ✓ OP ✓ answer (3)
6.1.3	$\sin(\theta + 90°) = \frac{b}{6,5}$ $\cos\theta = \frac{b}{6,5}$ $\frac{-5}{13} = \frac{b}{6,5}$ $b = -\frac{5}{2}$  **OR** $\cos(90° + \theta) = \frac{a}{6,5}$ $-\sin\theta = \frac{a}{6,5}$ $-\frac{12}{13} = \frac{a}{6,5}$ $\therefore a = -6$ $b = \sqrt{(6,5)^2 - (-6)^2} = -\frac{5}{2}$	✓ $\sin(\theta + 90°) = \frac{b}{6,5}$ ✓ $\cos\theta$ ✓ $\frac{-5}{13} = \frac{b}{6,5}$ ✓ value of b (4) ✓ $\cos(\theta + 90°) = \frac{a}{6,5}$ ✓ $-\sin\theta$ ✓ value of a ✓ value of b (4)

6.2	$\frac{\sin 2x.\cos(-x)+\cos 2x.\sin(360°-x)}{\sin(180°+x)}$ $=\frac{\sin 2x\ \cos x\ +\ \cos 2x(-\sin x)}{-\sin x}$ $=\frac{\sin(2x-x)}{-\sin x}$ $=\frac{\sin x}{-\sin x}$ $=-1$	✓ $\cos(-x)=\cos x$ ✓ $\sin(360°-x)=-\sin x$ ✓ $\sin(180°+x)=-\sin x$ ✓ numerator = $\sin x$ ✓ answer (5)
6.3	$6\sin^2 x+7\cos x-3=0$ $6(1-\cos^2 x)+7\cos x-3=0$ $6-6\cos^2 x+7\cos x-3=0$ $6\cos^2 x-7\cos x-3=0$ $(3\cos x+1)(2\cos x-3)=0$ $\cos x=-\frac{1}{3}$ or $\cos x=\frac{3}{2}$ (N/A) $\therefore\ x=109{,}47°+k.360°;\ k\in Z$ or $x=250{,}53°+k.360°;\ k\in Z$	✓ identity ✓ standard form ✓ factors ✓ both solutions of $\cos x$ ✓ $x=109{,}47°\ \&\ 250{,}53°$ ✓ $+k.360°;\ k\in Z$ (6)
6.4	$x+\frac{1}{x}=3\cos A$ $(3\cos A)^2=\left(x+\frac{1}{x}\right)^2$ $9\cos^2 A=x^2+\frac{1}{x^2}+2$ $9\cos^2 A=2+2$ $\cos^2 A=\frac{4}{9}$ $\cos 2A=2\cos^2 A-1$ $=2\left(\frac{4}{9}\right)-1$ $=-\frac{1}{9}$ **OR**	✓squaring both sides ✓ $9\cos^2 A=x^2+\frac{1}{x^2}+2$ ✓ $\cos^2 A=\frac{4}{9}$ ✓ $\cos 2A=2\cos^2 A-1$ ✓ answer (5)

	$x^2 - 2 + \frac{1}{x^2} = 0$ $\left(x - \frac{1}{x}\right)^2 = 0$ $x^2 = 1$ $x = \pm 1$ $3\cos A = 2$ or $3\cos A = -2$ $\cos A = \frac{2}{3}$ or $\cos A = -\frac{2}{3}$ $\cos 2A = 2\cos^2 A - 1$ $= 2\left(\pm\frac{2}{3}\right)^2 - 1$ $= -\frac{1}{9}$	✓ $x = \pm 1$ ✓ $\cos A = \frac{2}{3}$ ✓ $\cos A = -\frac{2}{3}$ ✓double angle identity ✓ answer (5)
		[24]

QUESTION/*VRAAG* 7



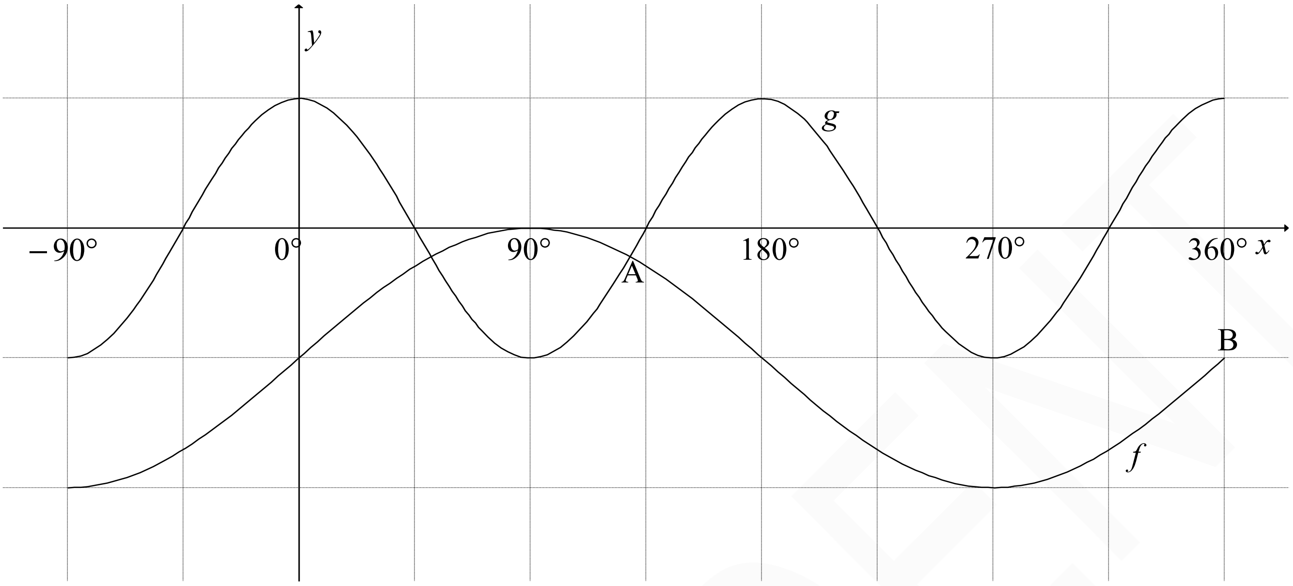
7.1	$\tan 30° = \frac{\sqrt{3}\,r}{QS}$ $QS = \frac{\sqrt{3}r}{\tan 30°}$ $= \frac{\sqrt{3}r}{\frac{1}{\sqrt{3}}}$ *or* $\frac{\sqrt{3}r}{\frac{\sqrt{3}}{3}}$ $= 3r$ **OR** $\tan 60° = \frac{QS}{\sqrt{3}r}$ $\sqrt{3} = \frac{QS}{\sqrt{3}r}$ $QS = 3r$	✓✓ trig ratio ✓ QS subject (3)
7.2	Area of flower garden $= \pi(3r)^2 - \pi r^2$ $= 9\pi r^2 - \pi r^2$ $= 8\pi r^2$	✓ substitution into difference of areas ✓ answer (2)
7.3	$RS^2 = r^2 + (3r)^2 - 2(r)(3r)\cos 2x$ $= r^2 + 9r^2 - 6r^2 \cos 2x$ $= 10r^2 - 6r^2 \cos 2x$ $= r^2(10 - 6\cos 2x)$ $RS = r\sqrt{10 - 6\cos 2x}$	✓substitution into cosine rule correctly ✓ $10r^2 - 6r^2 \cos 2x$ ✓ $r^2(10 - 6\cos 2x)$ (3)
7.4	$RS = 10\sqrt{10 - 6\cos 2(56)}$ $= 34,9966...$ ≈ 35 m	✓substitution ✓ answer (2)
		[10]

QUESTION/*VRAAG* 5

5.1	$\dfrac{\sin x}{\cos x.\tan x}+\sin(180°+x)\cos(90°-x)$ $=\dfrac{\sin x}{\cos x.\dfrac{\sin x}{\cos x}}+(-\sin x)\sin x$ $=1-\sin^2 x$ $=\cos^2 x$	✓ $-\sin x$ ✓ $\sin x$ ✓ $\tan x=\dfrac{\sin x}{\cos x}$ ✓ $1-\sin^2 x$ ✓ $\cos^2 x$ (5)
5.2	$\dfrac{\sin^2 35°-\cos^2 35°}{4\sin 10°\cos 10°}$ $=\dfrac{-\left(\cos^2 35°-\sin^2 35°\right)}{2(2\sin 10°\cos 10°)}$ $=\dfrac{-\cos 70°}{2\sin 20°}$ $=\dfrac{-\cos 70°}{2\cos 70°}$ **OR** $=\dfrac{-\sin 20°}{2\sin 20°}$ $=-\dfrac{1}{2}$	✓ $-\left(\cos^2 35°-\sin^2 35°\right)$ ✓ $-\cos 70°$ ✓ $2\sin 20°$ ✓ answer (4)
5.3	$2\sin^2 77°=2[\sin(90°-13°)]^2$ $=2\cos^2 13°$ $=2\cos^2 13°-1+1$ $=\cos 26°+1$ $=m+1$ **OR** $1-2\sin^2 77°=\cos 154°$ $2\sin^2 77°=1-\cos 154°$ $=1-(-\cos 26°)$ $=1+m$	✓ using co-ratio ✓ reduction ✓ $2\cos^2 13°-1=\cos 26°$ ✓ answer (4) ✓ $1-2\sin^2 77°=\cos 154°$ ✓ $2\sin^2 77°=1-\cos 154°$ ✓ reduction ✓ answer (4)
5.4.1	$\sin(x+25°)\cos 15°-\cos(x+25°)\sin 15°=\tan 165°$ $\sin(x+25°-15°)=-0{,}2679...$ *OR* $-2+\sqrt{3}$ $\sin(x+10°)=-0{,}2679...$*OR* $-2+\sqrt{3}$ $x+10°=195{,}54°+k.360°$ or $x+10°=344{,}46°+k.360°$ $x=185{,}54°+k.360°;\ k\in Z$ or $x=334{,}46°+k.360°;k\in Z$ **OR/*OF***	✓✓ $\sin(x+10°)$ ✓ $-0{,}2679...$ ✓ 195,54° & 344,46° ✓ 185,54° & 334,46° ✓ $+k.360°;\ k\in Z$ (6)

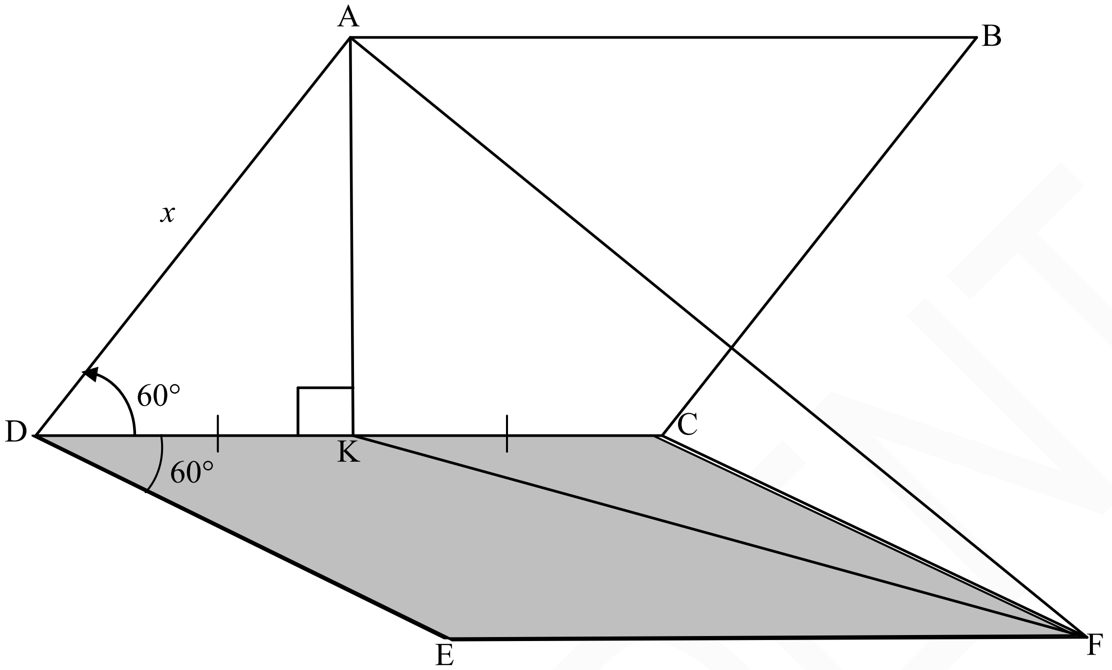
	$\sin(x+25°)\sin 75° - \cos(x+25°)\cos 75° = \tan 165°$ $-(\cos(x+25°)\cos 75° - \sin(x+25°)\sin 75°) = -0{,}2679...$ $\cos(x+100°) = 0{,}2679...$ ref. $\angle = 74.4577...°$ $x+100° = 74{,}46° + k.360°$ *or* $x+100° = 285{,}54° + k.360°$ $x = -25{,}54° + k.360°;\ k \in Z$ or $x = 185{,}54° + k.360°;\ k \in Z$	✓✓ $\cos(x+100°)$ ✓ $-0{,}2679...$ ✓ 74,46° & 285,54° ✓ $-25{,}54°$ & 185,54° ✓ $+k.360°;\ k \in Z$ (6)
5.4.2	$f(x) = \sin(x+10°)$ **Answers only: Full marks** For minimum value of $\sin x$: $x = 270°$ For minimum value of $\sin(x+10°)$: $x = 260°$	✓ $f(x) = \sin(x+10°)$ ✓ 270° ✓ answer (3)
		[22]

QUESTION/*VRAAG* 6



6.1	Range of f: $y \in [-2\ ;0]$ **OR** $-2 \le y \le 0$	✓ critical values ✓ notation (2)
6.2	$x \in (90°\ ;\ 270°)$ OR $x \in [90°\ ;\ 270°]$	✓ critical values ✓ notation (2)
6.3	$PQ = \cos 2x - (\sin x - 1)$ $= 1 - 2\sin^2 x - \sin x + 1$ $= -2\sin^2 x - \sin x + 2$ $\sin x = -\frac{b}{2a}$ $= \frac{-(-1)}{2(-2)}$ $\sin x = -\frac{1}{4}$ $\therefore\ x = 194{,}48°$ or $x = 345{,}52°$	✓ $PQ = \cos 2x - (\sin x - 1)$ ✓ $\cos 2x = 1 - 2\sin^2 x$ ✓substitution into formula ✓ $\sin x = -\frac{1}{4}$ ✓ 194,48° ✓ 345,52° (6)
		[10]

QUESTION/*VRAAG* 7



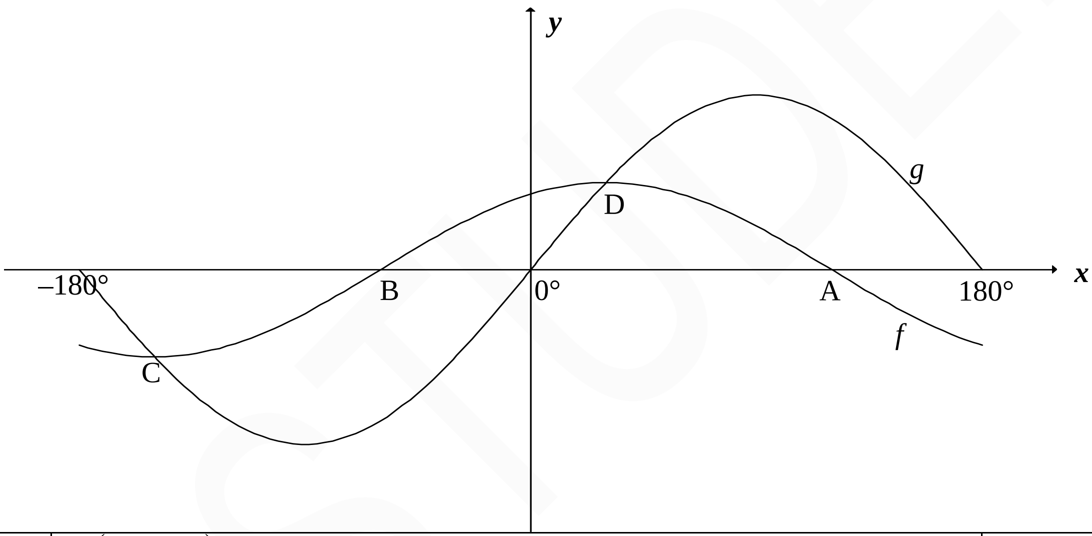
7.1	$\sin 60° = \frac{AK}{x}$ $AK = x\sin 60°$ or $\frac{\sqrt{3}}{2}x$ or $0{,}866x$	✓ trig ratio ✓ answer (2)
7.2	$K\hat{C}F = 120°$	✓ answer (1)
7.3	$KF^2 = CF^2 + CK^2 - 2CF.CK\cos K\hat{C}F$ $= x^2 + \left(\frac{x}{2}\right)^2 - 2x\left(\frac{x}{2}\right)\cos 120°$ $= x^2 + \frac{x^2}{4} - x^2\left(-\frac{1}{2}\right)$ $= \frac{7x^2}{4}$ $KF = \frac{\sqrt{7}x}{2}$ $A\hat{K}F = y$ Area $\Delta AKF = \frac{1}{2}.AK.KF\sin A\hat{K}F$ $= \frac{1}{2}.\frac{\sqrt{3}x}{2}.\frac{\sqrt{7}x}{2}\sin y$ $= \frac{x^2\sqrt{21}\sin y}{8}$	✓ correct use of cosine rule ✓substitution ✓ $\cos 120° = -\frac{1}{2}$ ✓ $KF = \frac{\sqrt{7}x}{2}$ ✓ correct use of area rule ✓substitution ✓ answer in terms of x and y (7)
		[10]

QUESTION/*VRAAG* 5

5.1.1	$\sin 191°$ $= -\sin 11°$	✓ $-\sin 11°$ (1)
5.1.2	$\cos 22°$ $= \cos(2 \times 11°)$ $= 1 - 2\sin^2 11°$	✓ answer (1)
5.2	$\cos(x - 180°) + \sqrt{2}\sin(x + 45°)$ $= -\cos x + \sqrt{2}(\sin x \cos 45° + \cos x \sin 45°)$ $= -\cos x + \sqrt{2}\left(\sin x\left(\frac{1}{\sqrt{2}}\right) + \cos x\left(\frac{1}{\sqrt{2}}\right)\right)$ $= -\cos x + \sin x + \cos x$ $= \sin x$ **OR** $\cos(x - 180°) + \sqrt{2}\sin(x + 45°)$ $= -\cos x + \sqrt{2}(\sin x \cos 45° + \cos x \sin 45°)$ $= -\cos x + \sqrt{2}\left(\sin x\left(\frac{\sqrt{2}}{2}\right) + \cos x\left(\frac{\sqrt{2}}{2}\right)\right)$ $= -\cos x + \sin x + \cos x$ $= \sin x$	✓ $-\cos x$ ✓ expansion ✓ special angle ratios ✓simplification of last 2 terms ✓answer (5) ✓ $-\cos x$ ✓ expansion ✓ special angle ratios ✓simplification of last 2 terms ✓answer (5)
5.3	$\sin P + \sin Q = \sin P + \cos P$ $(\sin P + \cos P)^2 = \left(\frac{7}{5}\right)^2$ $\sin^2 P + 2\sin P\cos P + \cos^2 P = \frac{49}{25}$ $2\sin P\cos P = \frac{49}{25} - 1$ $\sin 2P = \left(\frac{49}{25} - \frac{25}{25}\right)$ $= \frac{24}{25}$	✓ $\sin Q = \cos P$ ✓ squaring ✓ expansion ✓ $\sin^2 P + \cos^2 P = 1$ ✓answer (5)
		[12]

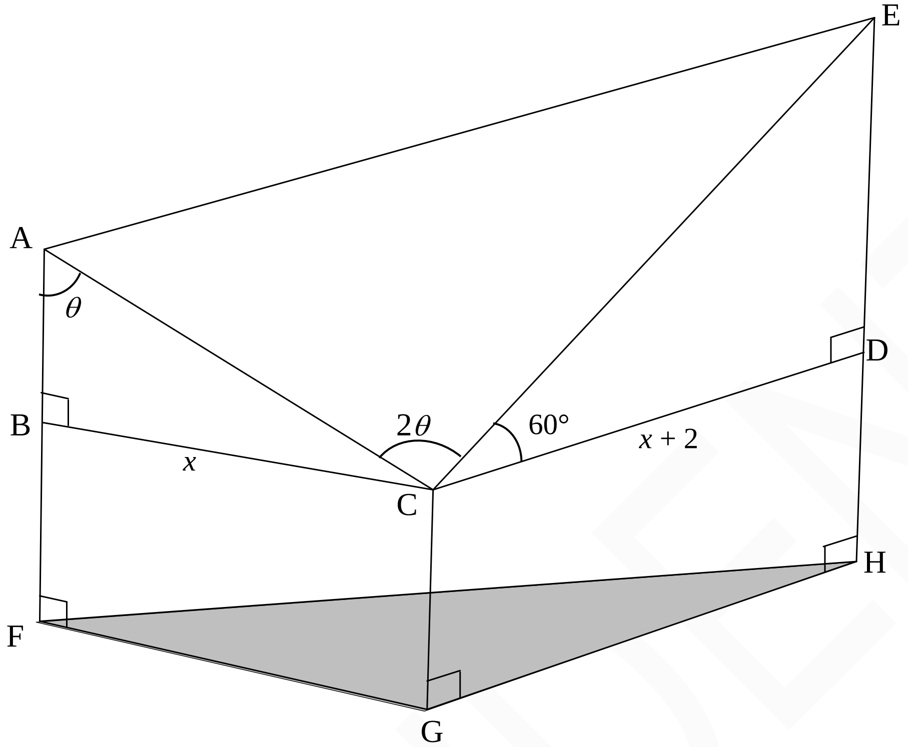
QUESTION/*VRAAG* 6

6.1	$\cos(x-30°) = 2\sin x$ $\cos x\cos 30° + \sin x \sin 30° = 2\sin x$ $\frac{\sqrt{3}}{2}\cos x + \frac{1}{2}\sin x = 2\sin x$ $\frac{\sqrt{3}}{2}\cos x = \frac{3}{2}\sin x$ $\tan x = \frac{\sqrt{3}}{3}$ $x = 30° + k.180°;\quad k \in Z$ **OR** $x = 30° + k.360°$ or $x = 210° + k.360°;\quad k \in Z$	✓ expansion ✓ special ∠s ✓ simplification ✓ equation in tan ✓ 30° ✓ $k.180°$; $k \in Z$ **OR** ✓ 30° and 210° ✓ $k.360°$; $k \in Z$ (6)



6.2.1(a)	A(120° ; 0)	✓ answer (1)
6.2.1(b)	C(–150° ; –1)	✓ x value ✓ y value (2)
6.2.2(a)	$x \in (-90° ; 30°)$ OR $-90° < x < 30°$	✓ endpoints ✓ correct interval (2)
6.2.2(b)	$x \in (-160° ; 20°)$ OR $-160° < x < 20°$	✓endpoints ✓correct interval (2)
6.2.3	$y = 2^{2\sin x+3}$ Range of $y = 2\sin x$: $y \in [-2 ; 2]$ **OR** $-2 \le y \le 2$ Range of $y = 2\sin x + 3$: $y \in [1 ; 5]$ **OR** $1 \le y \le 5$ Range: $y = 2^{2\sin x+3}$: $y \in [2 ; 32]$ **OR** $2 \le y \le 32$ Answer only: full marks	✓ 1 ✓ 5 ✓ 2 ✓ 32 ✓ correct interval (5)
		[18]

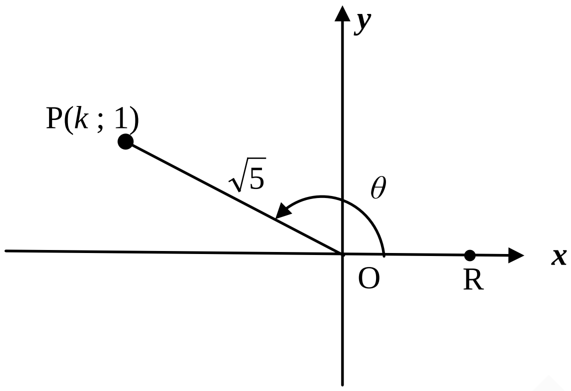
QUESTION/*VRAAG* 7



7.1.1	$\sin\theta = \frac{x}{AC}$ $AC = \frac{x}{\sin\theta}$ **OR** $\frac{\sin\theta}{x} = \frac{\sin 90°}{AC}$ $AC = \frac{x}{\sin\theta}$	✓ trig ratio ✓ simplification (2)
7.1.2	$\cos 60° = \frac{x+2}{CE}$ $CE = \frac{x+2}{\cos 60°}$ $= \frac{x+2}{\frac{1}{2}} = 2(x+2)$ **OR** $\frac{\sin 30}{x+2} = \frac{\sin 90°}{CE}$ $CE = \frac{x+2}{\sin 30°}$ $= 2(x+2)$	✓ trig ratio ✓ making CE the subject (2)
7.2	Area $\Delta ACE = \frac{1}{2}AC.EC.\sin A\hat{C}E$ $= \frac{1}{2}\left(\frac{x}{\sin\theta}\right)(2(x+2))\sin 2\theta$ $= \frac{x(x+2)\times 2\sin\theta\cos\theta}{\sin\theta}$ $= 2x(x+2)\cos\theta$	✓ use area rule correctly ✓ substitution of $\frac{x}{\sin\theta}(2(x+2))$ ✓ substitution of $\sin 2\theta$ (3)

7.3	EC = 2(12 + 2) = 28 $AE^2 = AC^2 + EC^2 - 2(AC)(EC)\cos A\hat{C}E$ $= \left(\frac{12}{\sin 55°}\right)^2 + 28^2 - 2\left(\frac{12}{\sin 55°}\right)(28)\cos 110°$ $AE = 35{,}77m$	✓ EC ✓ use cosine rule correctly ✓ substitution ✓ answer (4)
		[11]

QUESTION/*VRAAG* 5

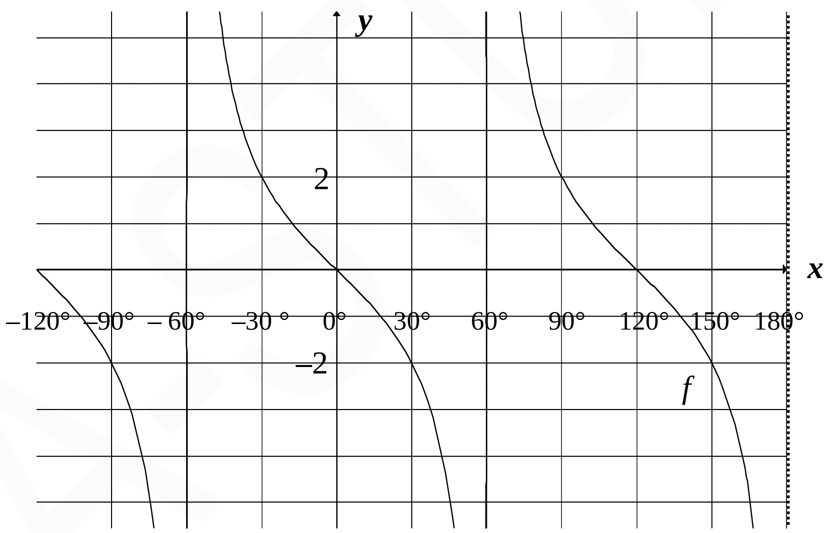


5.1.1	$k^2 = (\sqrt{5})^2 - 1^2$ $= 4$ $k = -2$ Answer only: full marks	✓ substitution into theorem of Pythagoras ✓ answer (2)
5.1.2(a)	$\tan\theta = -\frac{1}{2}$	✓answer (1)
5.1.2(b)	$\cos(180° + \theta) = -\cos\theta$ $= \frac{2}{\sqrt{5}}$ Answer only: full marks	✓ reduction ✓ answer (2)
5.1.2(c)	$\sin(\theta + 60°) = \frac{a+b}{\sqrt{20}}$ LHS $= \sin\theta\cos 60° + \cos\theta\sin 60°$ $= \left(\frac{1}{\sqrt{5}}\right)\left(\frac{1}{2}\right) + \left(-\frac{2}{\sqrt{5}}\right)\left(\frac{\sqrt{3}}{2}\right)$ $= \frac{1-2\sqrt{3}}{2\sqrt{5}}$ $= \frac{1-2\sqrt{3}}{\sqrt{20}}$	✓ expansion ✓ subst of sin θ ✓ subst of cos θ ✓ both special ∠s ✓ $\frac{1-2\sqrt{3}}{2\sqrt{5}}$ (5)
5.1.3	$\tan\theta = -\frac{1}{2}$ $\therefore \theta = 180° - 26{,}57°$ $\therefore \theta = 153{,}43°$ $\tan(2\theta - 40°) = \tan[(2 \times 153{,}43°) - 40°]$ $= \tan 266{,}87°$ $= 18{,}3$	✓ θ ✓ substitution ✓ answer (3)

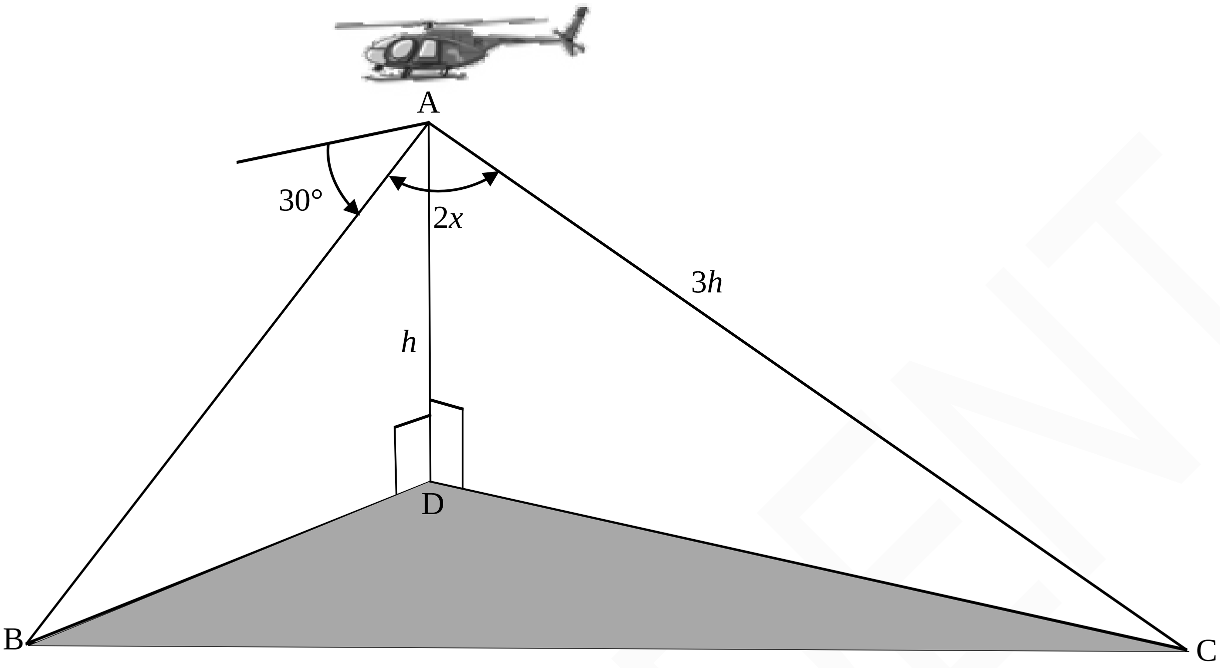
5.2	LHS $= \dfrac{\cos x + \sin x}{\cos x - \sin x} - \dfrac{\cos x - \sin x}{\cos x + \sin x}$ RHS $= 2\tan 2x$	
	$= \dfrac{(\cos x + \sin x)^2 - (\cos x - \sin x)^2}{(\cos x - \sin x)(\cos x + \sin x)}$	✓ single fraction
	$= \dfrac{\cos^2 x + 2\sin x\cos x + \sin^2 x - \cos^2 x + 2\sin x\cos x - \sin^2 x}{\cos^2 x - \sin^2 x}$	✓ expansion
	$= \dfrac{2(2\sin x\cos x)}{\cos^2 x - \sin^2 x}$	✓ simplification (both)
	$= \dfrac{2\sin 2x}{\cos 2x}$	✓ double ∠ identity ✓ double ∠ identity
	$= 2\tan 2x$ $=$ RHS	
	OR/*OF*	(5)
	LHS $= \dfrac{\cos x + \sin x}{\cos x - \sin x} - \dfrac{\cos x - \sin x}{\cos x + \sin x}$ RHS $= 2\tan 2x$	
	$= \dfrac{(\cos x + \sin x)^2 - (\cos x - \sin x)^2}{(\cos x - \sin x)(\cos x + \sin x)}$	✓ single fraction
	$= \dfrac{(\cos x + \sin x + \cos x - \sin x)(\cos x + \sin x - \cos x + \sin x)}{\cos^2 x - \sin^2 x}$	✓ difference of two squares
	$= \dfrac{(2\cos x)(2\sin x)}{\cos^2 x - \sin^2 x}$	
	$= \dfrac{2(2\sin x\cos x)}{\cos^2 x - \sin^2 x}$	✓ simplification (both)
	$= \dfrac{2\sin 2x}{\cos 2x}$	✓ double ∠ identity ✓ double ∠ identity
	$= 2\tan 2x$ $=$ RHS	(5)
	OR/*OF*	
	RHS $= 2\tan 2x$	
	$= \dfrac{2\sin 2x}{\cos 2x}$	
	$= \dfrac{2(2\sin x.\cos x)}{\cos^2 x - \sin^2 x}$	✓ double ∠ identity ✓ double ∠ identity
	$= \dfrac{4\sin x.\cos x}{\cos^2 x - \sin^2 x}$	
	$= \dfrac{1 + 2\sin x.\cos x - (1 - 2\sin x.\cos x)}{\cos^2 x - \sin^2 x}$	✓ identity & method
	$= \dfrac{(\cos x + \sin x)^2 - (\cos x - \sin x)^2}{(\cos x + \sin x)(\cos x - \sin x)}$	✓ factorising numerator and denominator
	$= \dfrac{(\cos x + \sin x)^2}{(\cos x + \sin x)(\cos x - \sin x)} - \dfrac{(\cos x - \sin x)^2}{(\cos x + \sin x)(\cos x - \sin x)}$	✓ writing as 2 terms
	$= \dfrac{\cos x + \sin x}{\cos x - \sin x} - \dfrac{\cos x - \sin x}{\cos x + \sin x} =$ LHS	(5)

5.3	$\sum_{A=38^\circ}^{52^\circ}\cos^2 A$ $= \cos^2 38° + \cos^2 39° + \cos^2 40° + ... + \cos^2 51° + \cos^2 52°$ $= \sin^2 52° + \sin^2 51° + \sin^2 50° + ... + \cos^2 51° + \cos^2 52°$ $= 7(1) + \cos^2 45°$ $= 7 + \left(\frac{\sqrt{2}}{2}\right)^2$ or $= 7 + \left(\frac{1}{\sqrt{2}}\right)^2$ $= 7\frac{1}{2}$ **OR/*OF*** $\sum_{A=38^\circ}^{52^\circ}\cos^2 A$ $= \cos^2 38° + \cos^2 39° + \cos^2 40° + ... + \cos^2 51° + \cos^2 52°$ $= (\cos^2 38° + \sin^2 52°) + (\cos^2 39° + \sin^2 51°)... + \cos^2 45°$ $= 7(1) + \cos^2 45°$ $= 7 + \left(\frac{\sqrt{2}}{2}\right)^2$ or $= 7 + \left(\frac{1}{\sqrt{2}}\right)^2$ $= 7\frac{1}{2}$	✓ expansion ✓ co ratio ✓ $\cos^2 45°$ ✓ 7 × identity ✓ answer (5) ✓ expansion ✓ pairing ✓ $\cos^2 45°$ ✓ 7 × identity ✓ answer (5)
		[23]

QUESTION/*VRAAG* 6

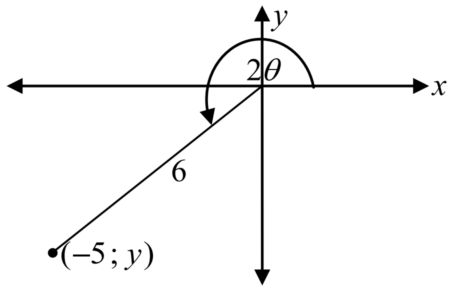
6.1	Period = 120°	✓ answer (1)
6.2	$2 = -2\tan\frac{3}{2}x$ $\tan\left(\frac{3}{2}t\right) = -1$ $\frac{3}{2}t = 135° + k.180°$ **OR/*OF*** $\frac{3}{2}t = -45° + k.180°$ $t = 90° + k.120°$; $k \in Z$ $t = -30° + k.120°$; $k \in Z$ **OR/*OF*** $2 = -2\tan\frac{3}{2}x$ $\tan\left(\frac{3}{2}t\right) = -1$ $\frac{3}{2}t = 135° + k.360°$ **o**r/of $\frac{3}{2}t = 315° + k.360°$ $t = 90° + k.240°$ **o**r.of $t = 210° + k.240°$; $k \in Z$	✓ equating ✓ general solution of $\frac{3}{2}t$ ✓ general solution of t (3) ✓ equating ✓ general solution of $\frac{3}{2}t$ ✓ general solution of t (3)
6.3		✓asymptotes: $x = \pm 60°$; $x = 180°$ ✓x-intercepts 0°; ±120° ✓ negative shape ✓ (90° ; 2) or (− 30° ; 2) or (30° ; − 2) or (− 90° ; − 2) (4)
6.4	$x \in (-60°\ ;\ -30°]$ or $(60°\ ;\ 90°]$ **OR/*OF*** $-60° < x \leq -30°$ or $60° < x \leq 90°$	✓ interval ✓ interval ✓ notation (3) ✓ interval ✓ interval ✓ notation (3)
6.5	$g(x) = -2\tan\left[\frac{3}{2}(x + 40°)\right] = f(x + 40°)$ Translation of 40° to the left / skuif met 40° links	✓ Translation of 40° ✓ to the left (2)
		[13]

QUESTION/*VRAAG* 7



7.1	$\hat{ABD} = 30°$ $\sin 30° = \frac{h}{AB}$ $AB = \frac{h}{\sin 30°}$ **OR** $AB = \frac{h}{\frac{1}{2}}$ **OR** $AB = 2h$ **OR/*OF*** $B\hat{A}D = 60°$ $\cos 60° = \frac{h}{AB}$ $AB = \frac{h}{\cos 60°}$ **OR** $AB = \frac{h}{\frac{1}{2}}$ **OR** $AB = 2h$	✓ $A\hat{B}D = 30°$ ✓ answer (2) ✓ $B\hat{A}D = 60°$ ✓ answer (2)
7.2	$BC^2 = AB^2 + AC^2 - 2AB.AC\cos B\hat{A}C$ $= (2h)^2 + (3h)^2 - 2(2h)(3h)\cos 2x$ $= 13h^2 - 12h^2(2\cos^2 x - 1)$ $= 13h^2 - 24h^2\cos^2 x + 12h^2$ $= 25h^2 - 24h^2\cos^2 x$ $BC = h\sqrt{25 - 24\cos^2 x}$	✓ use of cosine rule in ΔABC ✓ substitution ✓ double angle identity ✓ $25h^2 - 24h^2\cos^2 x$ (4)
		[6]

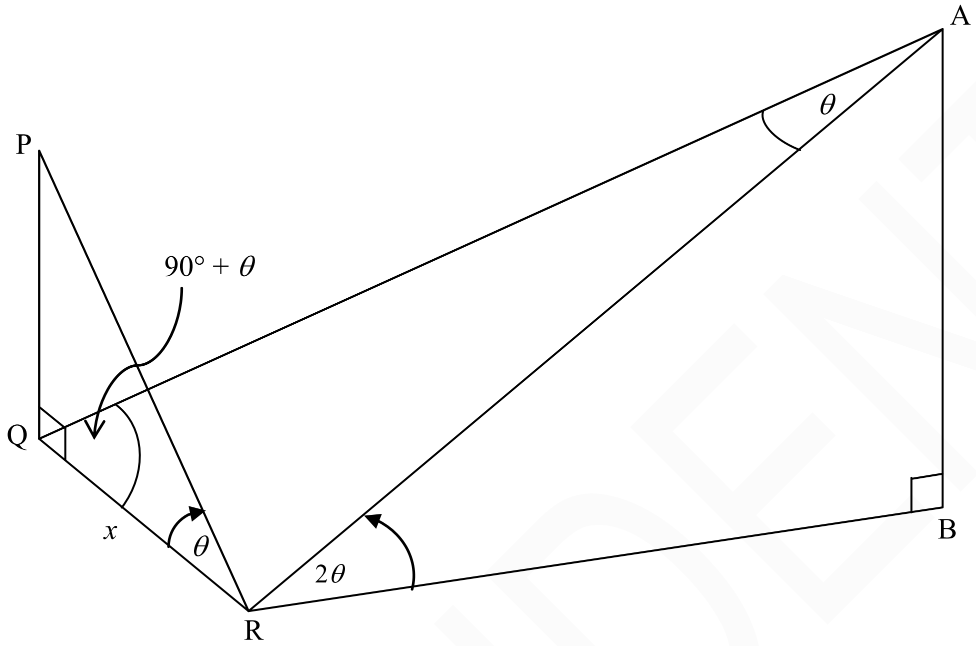
QUESTION/*VRAAG* 5

5.1.1 **no calculator in 5.1**	$\cos 2\theta = -\frac{5}{6}$, where $2\theta \in [180°; 270°]$  $y^2 = 6^2 - (-5)^2$ [Pythagoras] $y = \pm\sqrt{11}$ (5 ; y) is in 3rd quadrant: $\therefore\ y = -\sqrt{11}$ $\sin 2\theta = -\frac{\sqrt{11}}{6}$ Getting to $\sin 2\theta = \frac{\sqrt{11}}{6}$: 3/4 **OR/*OF*** $\sin^2 2\theta = 1 - \cos^2 2\theta$ $= 1 - \left(-\frac{5}{6}\right)^2$ $= 1 - \frac{25}{36}$ $= \frac{11}{36}$ $\sin 2\theta = -\frac{\sqrt{11}}{6}$	✓ diagram (3[rd] quadrant only) ✓ using Pythagoras ✓ y – value ✓ answer (4) .✓ $\sin^2 2\theta = 1 - \cos^2 2\theta$ ✓ substitution ✓ value of $\sin^2 2\theta$ ✓ answer (4)
5.1.2	$\cos 2\theta = 1 - 2\sin^2\theta$ $2\sin^2\theta = 1 - \cos 2\theta$ $\sin^2\theta = \frac{1 - \left(-\frac{5}{6}\right)}{2}$ $= \frac{11}{6} \times \frac{1}{2}$ $= \frac{11}{12}$	✓ $\cos 2\theta = 1 - 2\sin^2\theta$ ✓ substitution ✓ answer (3)

5.2	$\sin(180°-x).\cos(-x)+\cos(90°+x).\cos(x-180°)$ $=\sin x.\cos x-\sin x(-\cos x)$ $=2\sin x.\cos x$ $=\sin 2x$ Second line written as $\sin x \cos x + \sin x \cos x$: max 5/6	✓ $\sin x$ ✓ $\cos x$ ✓ $-\sin x$ ✓ $-\cos x$ ✓ simplification ✓ answer (6)
5.3	$\sin 3x.\cos y+\cos 3x.\sin y$ $\sin(3x+y)$ $=\sin 270°$ $=-1$	✓ compound angle ✓ answer (2)
5.4.1	$2\cos x=3\tan x$ $2\cos x=\frac{3\sin x}{\cos x}$ $2\cos^2 x=3\sin x$ $2(1-\sin^2 x)=3\sin x$ $2-2\sin^2 x=3\sin x$ $2\sin^2 x+3\sin x-2=0$	✓ $\tan x=\frac{\sin x}{\cos x}$ ✓ multiplying by $\cos\theta$ ✓ $\cos^2 x=1-\sin^2 x$ (3)
5.4.2	$2\sin^2 x+3\sin x-2=0$ $(2\sin x-1)(\sin x+2)=0$ $\sin x=\frac{1}{2}$ or $\sin x=-2$ (no solution) $x=30°+k.360°$ or $x=150°+k.360°$; $k\in Z$	✓ factors ✓ both values of $\sin x$ ✓ no solution ✓ $30°+k.360°$ ✓ $150°+k.360°$; $k\in Z$ (5)
5.4.3	$5y=30°+k.360°$ or $5y=150°+k.360°$ $y=6°+k.72°$ or $y=30°+k.72°$ $\therefore y=144°+6°$ or $y=144°+30°$ $y=150°$ or $y=174°$ **OR/*OF*** $144°\le y\le 216°$ $720°\le 5y\le 1080°$ $5y=750°$ or $5y=870°$ $y=150°$ or $y=174°$	✓ $y=6°+k.72°$ ✓ $y=30°+k.72°$ ✓ $150°$ ✓ $174°$ (4) ✓ $5y=750°$ ✓ $5y=870°$ ✓ $150°$ ✓ $174°$ (4)
5.5.1	$g(x)=-4\cos(x+30°)$ maximum value = 4	✓ answer (1)

5.5.2	range of/*waardeversameling van* $g(x)$: $-4 \leq y \leq 4$ **OR/*OF*** $y \in [-4\ ;\ 4]$ $\therefore$ range of/*waardeversameling van* $g(x) + 1$: $-3 \leq y \leq 5$ **OR/*OF*** $y \in [-3\ ;\ 5]$ Answer only: full marks	✓ range of $g(x)$ ✓ answer (2)
5.5.3	$y = -4\cos(x + 30°)$ shifted to the left/*skuif na links*: $y = -4\cos(x + 30° + 60°)$ $= -4\cos(x + 90°)$ $= 4\sin x$ $\therefore h(x) = -4\sin x$ Answer only: full marks	✓ shift of 60° to the left ✓ reduction ✓ equation of h (3) **[33]**

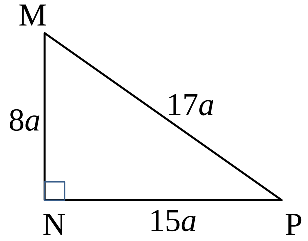
QUESTION/*VRAAG* 6



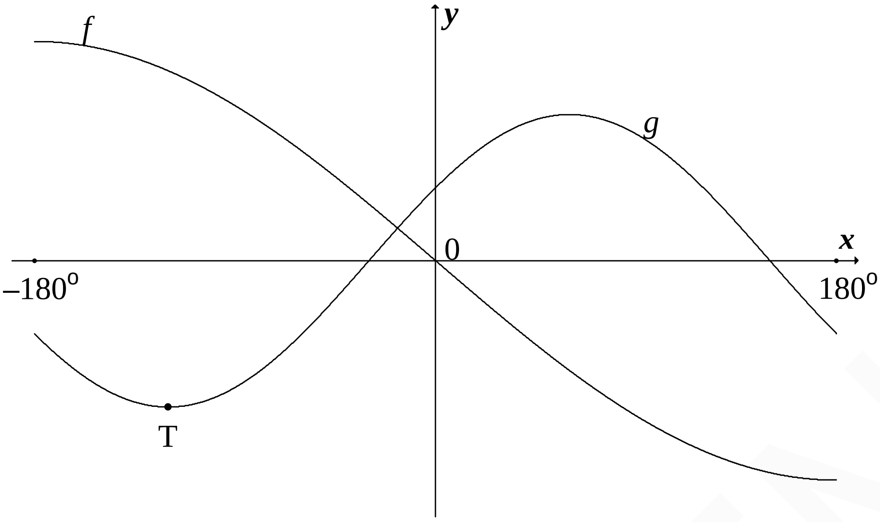
6.1.1	$\tan\theta = \frac{PQ}{QR} = \frac{PQ}{x}$ $\therefore PQ = x\tan\theta$ Answer only: full marks **OR/*OF*** $\frac{QR}{\sin P} = \frac{PQ}{\sin P\hat{R}Q}$ $\therefore PQ = \frac{x.\sin\theta}{\sin(90° - \theta)}$	✓ trig ratio ✓ answer (2) ✓ trig ratio ✓ answer (2)
6.1.2	$\frac{AR}{\sin A\hat{Q}R} = \frac{QR}{\sin Q\hat{A}R}$ $AR = \frac{x\sin(90° + \theta)}{\sin\theta}$ Answer only: full marks	✓ use of sine rule ✓ substitution into sine rule correctly (2)

6.2	$\sin 2\theta = \frac{AB}{AR}$ $AB = AR\sin 2\theta$ $= \frac{x\sin(90° + \theta).\sin 2\theta}{\sin\theta}$ $= \frac{x\cos\theta.\sin 2\theta}{\sin\theta}$ $= \frac{x\cos\theta.2\sin\theta\cos\theta}{\sin\theta}$ $= 2x\cos^2\theta$	✓ substitution into trig ratio and AB as subject ✓ substitution of AR ✓ co-ratio ✓ $\sin 2\theta = 2\sin\theta\cos\theta$ (4)
6.3	$\frac{AB}{QP} = \frac{2x\cos^2 12°}{x\tan 12°}$ $= 9$	✓ substitution CA from 6.1.1) ✓ answer (2) **[10]**

QUESTION/*VRAAG* 5

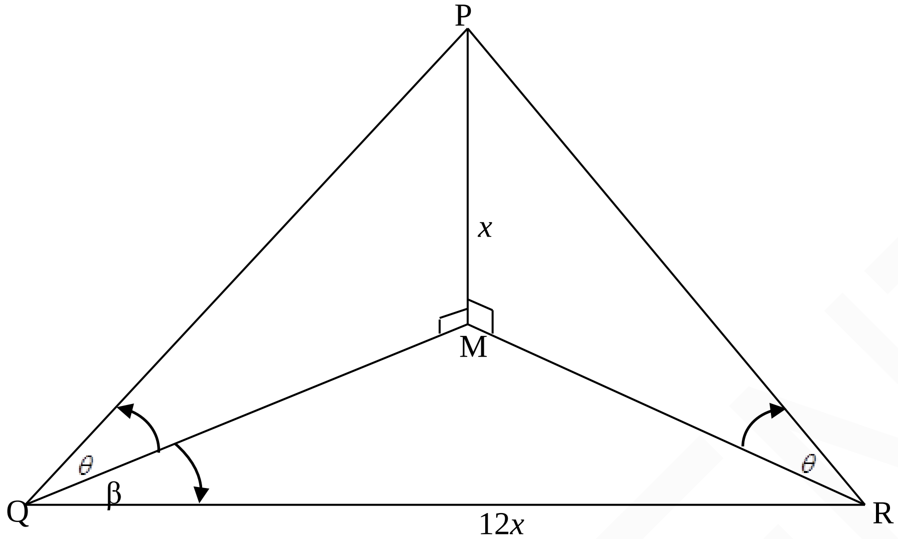
5.1.1	Given : $\sin M = \frac{15}{17}$ $MN^2 = 17^2 - 15^2$ $= 64$ $MN = 8$ OR  $\therefore \tan M = \frac{15}{8}$	✓ sketch or Pyth ✓ MN = 8 ✓answer (3)
5.1.2	$\sin M = \frac{NP}{MP}$ $\frac{NP}{51} = \frac{15a}{17a}$ $\therefore NP = 45$	✓ equating trig ratios ✓ answer (2)
5.2	$\cos(x - 360°).\sin(90° + x) + \cos^2(-x) - 1$ $= \cos x \,.\, \cos x + \cos^2 x - 1$ $= \cos^2 x + \cos^2 x - 1$ $= 2\cos^2 x - 1$ $= \cos 2x$	✓ $\cos x$ ✓ $\cos x$ ✓ $\cos^2 x$ ✓ identity (4)
5.3.1	$\sin(2x + 40°)\cos(x + 30°) - \cos(2x + 40°)\sin(x + 30°)$ $= \sin[(2x + 40°) - (x + 30°)]$ $= \sin(x + 10°)$	✓ reduction ✓ answer (2)
5.3.2	$\sin(2x + 40°)\cos(x + 30°) - \cos(2x + 40°)\sin(x + 30°) = \cos(2x - 20°)$ $\therefore \cos(2x - 20°) = \sin(x + 10°)$ $\cos(2x - 20°) = \cos[90° - (x + 10°)]$ $2x - 20° = 80° - x + k.360°$ or $2x - 20° = 360° - (80° - x) + k.360°$ $3x = 100° + k.360°$ or $2x - 20° = 280° + x + k.360°$ $x = 33{,}33° + k.120°$ or $x = 300° + k.360°$; $k \in Z$ **OR/*OF*** $\therefore \cos(2x - 20°) = \sin(x + 10°)$ $\sin[90° - (2x - 20°)] = \sin(x + 10°)$ $110° - 2x = x + 10° + k.360°$ or $110° - 2x = 180° - (x + 10°) + k.360°$ $3x = 100° - k.360°$ or $110° - 2x = 170° - x + k.360°$ $x = 33{,}33° - k.120°$ or $x = -60° - k.360°$; $k \in Z$	✓ equating ✓ co ratio ✓ $80° - x$ ✓$280° + x$ ✓ simplification/*vereenv* ✓ $x = 33{,}33° + k.120°$ ✓ $x = 300° + k.360°$; $k \in Z$ (7) ✓ equating ✓ co ratio ✓ $x + 10°$ ✓$170° - x$ ✓ simplification/*vereenv* ✓ $x = 33{,}33° - k.120°$ ✓ $x = -60° - k.360°$; $k \in Z$ (7)
		[18]

QUESTION/*VRAAG* 6



6.1	Period = 720°	✓ answer (1)
6.2	$y \in [-2\ ;\ 2]$ **OR/*OF*** $-2 \leq y \leq 2$	✓✓ answer (2) ✓✓ answer (2)
6.3	$f(-120°) - g(-120°)$ $= -3\sin\left(-\frac{120°}{2}\right) - 2\cos(-120° - 60°)$ $= \frac{4+3\sqrt{3}}{2}$ or 4,60 (4,5980...)	✓ $x = -120°$ ✓ substitution ✓ answer (3)
6.4.1	x-intercepts of g at –90° + 60° = –30° and 90° + 60° = 150° $\therefore x \in (-30°\ ;\ 150°)$ **OR/*OF*** x-intercepts of g at –90° + 60° = –30° and 90° + 60° = 150° $-30° < x < 150°$	✓ value ✓ value ✓ answer (3) ✓ value ✓ value ✓ answer (3)
6.4.2	$x \in [-180°\ ;\ -120°) \cup (-30°\ ; 60°) \cup (150°\ ; 180°]$ **OR/*OF*** $-180° \leq x < -120°$ or $-30° < x < 60°$ or $150° < x \leq 180°$	✓ $[-180°\ ;\ -120°)$ ✓ $(-30°\ ; 60°)$ ✓ $(150°\ ; 180°]$ ✓ notation for inclusive in the first/last interval (4) ✓ $-180° \leq x < -120°$ ✓ $-30° < x < 60°$ ✓ $150° < x \leq 180°$ 1 mark: each interval ✓ notation for inclusive in the first/last interval (4)
		[13]

QUESTION/*VRAAG* 7



7.1	In PMQ: $\tan\theta = \dfrac{x}{\text{QM}}$ $\therefore \text{QM} = \dfrac{x}{\tan\theta}$ **OR/*OF*** $\dfrac{x}{\sin\theta} = \dfrac{\text{MQ}}{\sin P}$ $MQ = \dfrac{x\sin P}{\sin\theta}$ $= \dfrac{x\cos\theta}{\sin\theta}$ $= \dfrac{x}{\tan\theta}$	✓ trig ratio ✓ answer (2) ✓ sine rule ✓ answer (2)
7.2	In PMR: $\tan\theta = \dfrac{x}{\text{MR}}$ *OR* $\text{PMQ} \equiv \text{PMR}$ [AAS/HHS] $\therefore \text{MR} = \dfrac{x}{\tan\theta} = \text{QM}$ $\text{Q}\hat{\text{M}}\text{R} = 180° - 2\beta$ $\dfrac{\sin\beta}{\text{MR}} = \dfrac{\sin \text{Q}\hat{\text{M}}\text{R}}{12x}$ $\sin\beta \times \dfrac{\tan\theta}{x} = \dfrac{\sin(180° - 2\beta)}{12x}$ $\tan\theta = \dfrac{\sin 2\beta}{12x} \times \dfrac{x}{\sin\beta}$ $\tan\theta = \dfrac{2\sin\beta\cos\beta}{12x} \times \dfrac{x}{\sin\beta}$ $\tan\theta = \dfrac{\cos\beta}{6}$ **OR**	✓ MR = QM ✓ correct substitution into the sine rule in ΔQMR ✓ reduction ✓ double angle (4)

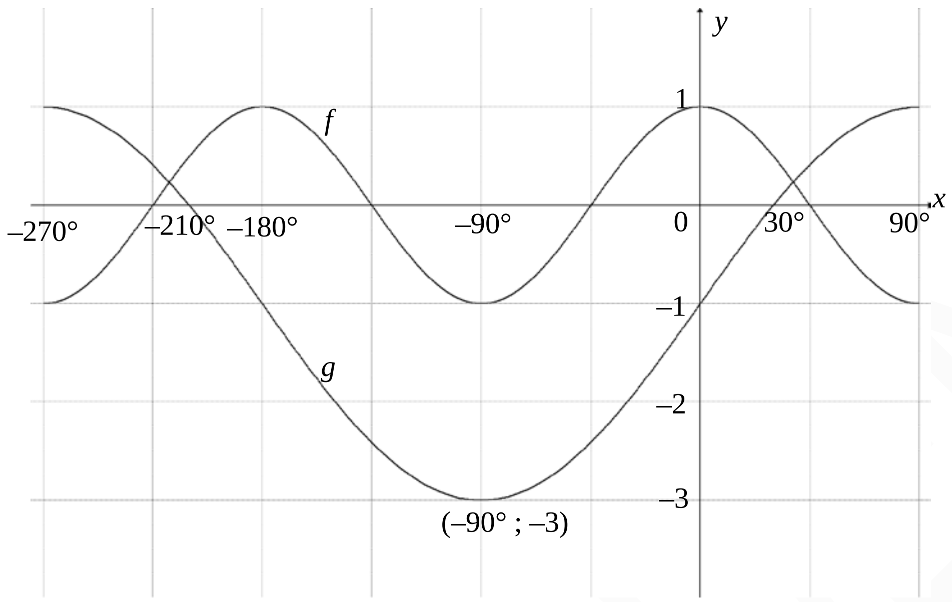
	In PMR : $\tan\theta = \frac{x}{MR}$ *OR* $PMQ \equiv PMR$ [AAS/HHS] $MR^2 = QM^2 + QR^2 - 2QM.QR\cos\beta$ $MR^2 = \left(\frac{x}{\tan\theta}\right)^2 + (12x)^2 - 2\left(\frac{x}{\tan\theta}\right)(12x)(\cos\beta)$ $\frac{x^2}{\tan^2\theta} = \frac{x^2}{\tan^2\theta} + 144x^2 - 24\left(\frac{x^2}{\tan\theta}\right)(\cos\beta)$ $24\left(\frac{x^2}{\tan\theta}\right)(\cos\beta) = 144x^2$ $\cos\beta = 6\tan\theta$ $\tan\theta = \frac{\cos\beta}{6}$	✓ correct substitution into the cosine rule in ΔQMR ✓ substitution ✓ MR = QM ✓ simplification (4)
7.3	$\frac{x}{QM} = \frac{\cos\beta}{6}$ [both equal $\tan\theta$] $x = \frac{60\cos 40}{6}$ x = 7,66 The height of the lighthouse is 8 metres	✓ equating ✓ subst. QM = 60 and $\beta = 40°$ ✓ answer (3)
		[9]

QUESTION/*VRAAG* 5

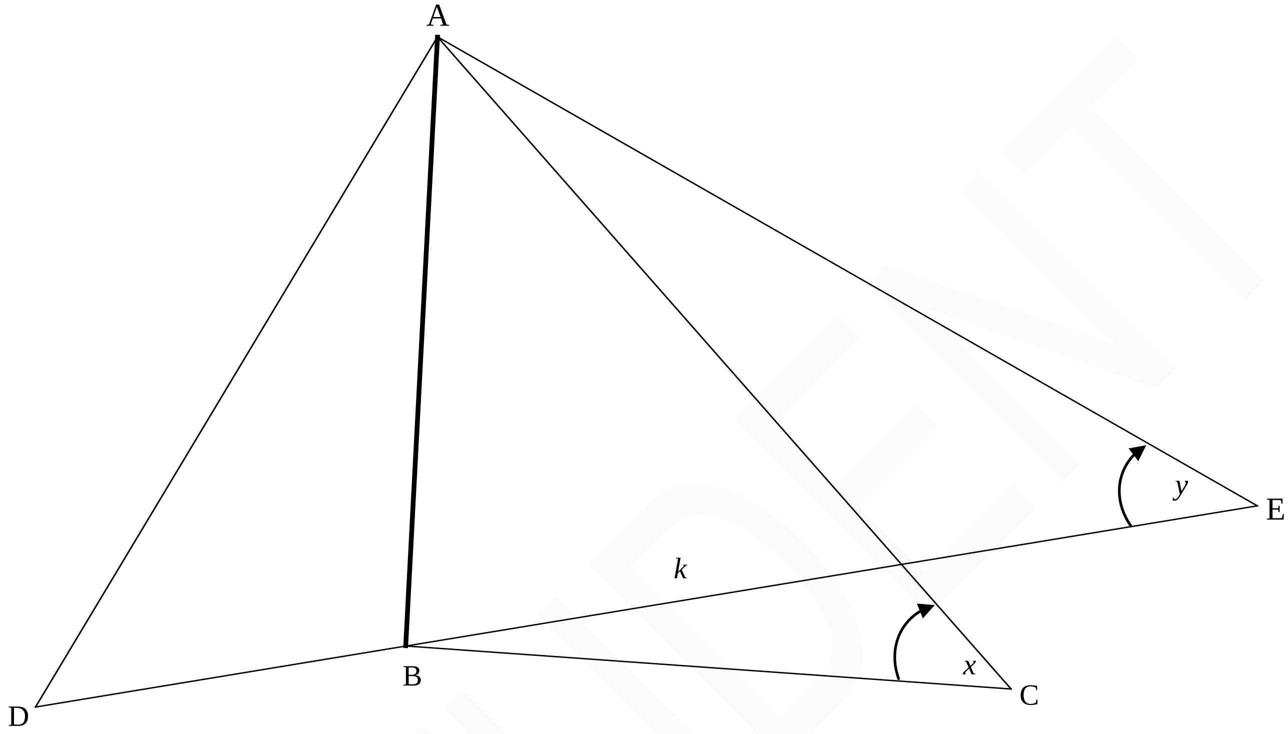
5.1	$\frac{\sin(A-360°).\cos(90°+A)}{\cos(90°-A).\tan(-A)}$ $=\frac{\sin A(-\sin A)}{\sin A(-\tan A)}$ $=\frac{\sin A}{\left(\frac{\sin A}{\cos A}\right)}$ $=\cos A$	✓ sin A ✓–sin A ✓ sin A ✓ –tan A ✓ $\tan A=\frac{\sin A}{\cos A}$ ✓ answer (6)
5.2.1	$t^2=(\sqrt{34})^2-(3)^2$ $\therefore t=-5$	✓ substitution ✓ answer (2)
5.2.2	$\tan\beta=\frac{-5}{3}$	✓ correct ratio (1)
5.2.3	$\cos 2\beta = 2\cos^2\beta-1$ $=2\left(\frac{3}{\sqrt{34}}\right)^2-1$ $=2\left(\frac{9}{34}\right)-1$ $=-\frac{16}{34}$ OR $-\frac{8}{17}$ **OR/*OF*** $\cos 2\beta=1-2\sin^2\beta$ $=1-2\left(-\frac{5}{\sqrt{34}}\right)^2$ $=1-2\left(\frac{25}{34}\right)$ $=-\frac{16}{34}$ OR $-\frac{8}{17}$ **OR/*OF*** $\cos 2\beta=\cos^2\beta-\sin^2\beta$ $=\left(\frac{3}{\sqrt{34}}\right)^2-\left(-\frac{5}{\sqrt{34}}\right)^2$ $=\frac{9}{34}-\frac{25}{34}$ $=-\frac{16}{34}$ OR $-\frac{8}{17}$	✓ compound formula ✓ substitution ✓ simplification ✓ answer (4) ✓ compound formula ✓ substitution ✓ simplification ✓ answer (4) ✓ compound formula ✓ substitution ✓ simplification ✓ answer (4)

5.3.1	LHS = sin(A + B) – sin(A – B) = sin A.cos B + cos A.sin B – (sin A. cos B – cos A. sin B) = sin A.cos B + cos A.sin B – sin A. cos B + cos A. sin B = 2cos A.sin B = RHS	✓ compound formula ✓ compound formula (2)
5.3.2	$\sin 77° - \sin 43° = \sin(60° + 17°) - \sin(60° - 17°)$ $= 2\cos 60°.\sin 17°$ $= 2 \times \frac{1}{2} \times \sin 17°$ $= \sin 17°$ **OR/*OF*** $\sin 77° - \sin 43° = \sin(60° + 17°) - \sin(60° - 17°)$ $= (\sin 60° \cos 17° + \cos 60° \sin 17°) -$ $(\sin 60° \cos 17° - \cos 60° \sin 17°)$ $= \frac{\sqrt{3}}{2}\cos 17° + \frac{1}{2}\sin 17° - \frac{\sqrt{3}}{2}\cos 17° + \frac{1}{2}\sin 17°$ $= \sin 17°$	✓ 60° + 17° ✓ 60° – 17° ✓ simplify ✓ $\frac{1}{2}$ (4) ✓ 60° + 17° ✓ 60° – 17° ✓ expansion ✓ $\frac{1}{2}$ (4) **[19]**

QUESTION/*VRAAG* 6

6.1		✓ (–90° ; –3) ✓ (0 ; –1) ✓ x – intercepts: –210° & 30° ✓ shape (4)
6.2	$\cos 2x = 2\sin x - 1$ $1 - 2\sin^2 x = 2\sin x - 1$ $2\sin^2 x + 2\sin x - 2 = 0$ $\sin^2 x + \sin x - 1 = 0$ $\sin x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-1 \pm \sqrt{1^2 - 4(1)(-1)}}{2(1)}$ $\sin x = \frac{-1+\sqrt{5}}{2}$, since $\sin x = \frac{-1-\sqrt{5}}{2} < -1$ has no solution	✓ $\cos 2x = 1 - 2\sin^2 x$ ✓ standard form ✓ using quadratic formula ✓ substitution into quadratic formula (4)
6.3	$\sin x = \frac{-1+\sqrt{5}}{2} = 0{,}618...$ Reference $\angle$ = 38,17° $\therefore$ x = 38,17° + k.360° or x = 141,83° + k.360° ; $k \in Z$ $\therefore$ x = 38,17° or −218,17° $y = 0{,}24$ $\therefore$ Points of intersection/*snypunte*: (38,17° ; 0,24) and (−218,17° ; 0,24)	✓ 38,17° ✓ 141,83° ✓–218,17° ✓ 0,24 (4) **[12]**

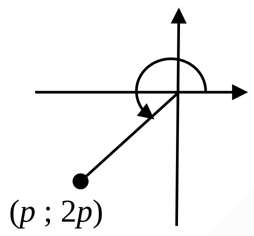
QUESTION/*VRAAG* 7



7.1	$A\hat{B}C = 90°$	✓ answer (1)
7.2	In Δ ABE: $\frac{AB}{BE} = \tan y$ $AB = k \tan y$ In Δ ABC: $\frac{AB}{AC} = \sin x$ $AC = \frac{AB}{\sin x}$ $= \frac{k \tan y}{\sin x}$	✓ correct ratio ✓ value AB ✓ correct ratio ✓ AC as subject and substitution (4)

7.3	$\hat{ADC} = \hat{ACD} = \frac{180° - 2x}{2} = 90° - x$ $\frac{DC}{\sin 2x} = \frac{AC}{\sin(90° - x)}$ $\frac{DC}{2\sin x \cos x} = \frac{AC}{\cos x}$ $DC = \frac{AC(2\sin x \cos x)}{\cos x}$ $= \frac{k \tan y}{\sin x} . \frac{2\sin x \cos x}{\cos x}$ $= 2k \tan y$	✓ $90° - x$ ✓subst into sine rule ✓ $2\sin x \cos x$ ✓ $\cos x$ ✓ substitution (5)
	OR/*OF* $DC^2 = AD^2 + AC^2 - 2AD.AC\cos 2x$ $= AC^2 + AC^2 - 2AC^2 \cos 2x$ $= 2AC^2(1 - \cos 2x)$ $= 2AC^2(1 - 1 + \sin^2 x)$ $= 4AC^2 \sin^2 x$ $DC = 2AC.\sin x$ $= 2\left(\frac{k.\tan y}{\sin x}\right).\sin x$ $= 2k.\tan y$	✓substitution into cos rule ✓ factorisation ✓ $1 - 2\sin^2 x$ ✓ DC ito AC and sin x ✓ substitution (5)
	OR/*OF* $DC^2 = AD^2 + AC^2 - 2AD.AC\cos 2x$ $= 2\left(\frac{k \tan y}{\sin x}\right)^2 - 2\left(\frac{k \tan y}{\sin x}\right)^2 \cos 2x$ $= \frac{2k^2 \tan^2 y}{\sin^2 x} - \frac{2k^2 \tan^2 y}{\sin^2 x}(1 - 2\sin^2 x)$ $= \frac{2k^2 \tan^2 y}{\sin^2 x} - \frac{2k^2 \tan^2 y}{\sin^2 x} + 4k^2 \tan^2 y$ $DC = \sqrt{4k^2 \tan^2 y}$ $= 2k \tan y$	✓correct cos rule ✓ substitution ✓ $1 - 2\sin^2 x$ ✓ squaring and multiplication ✓ $\sqrt{4k^2 \tan^2 y}$ (5) **[10]**

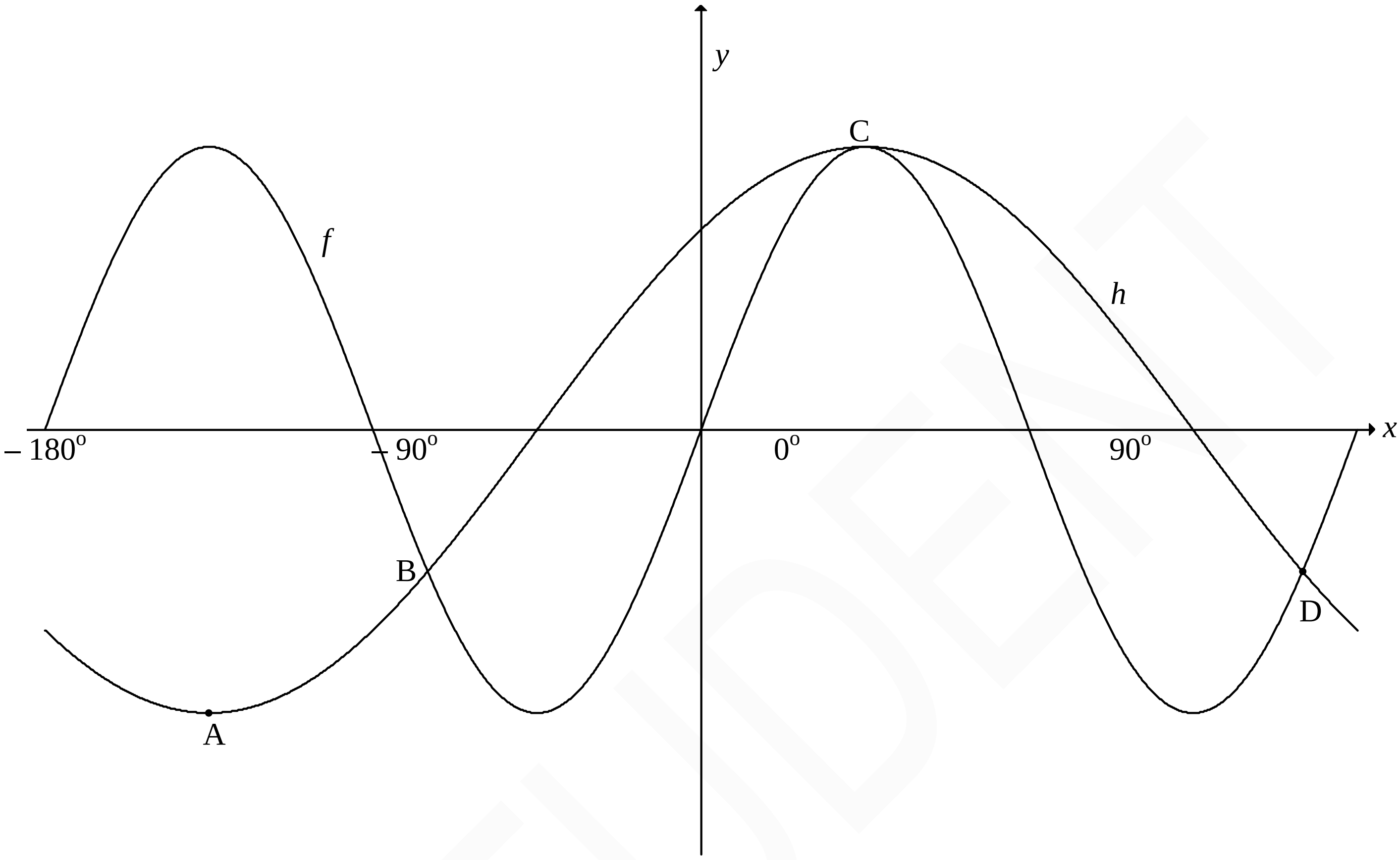
QUESTION/VRAAG 5

5.1.1	$\tan A = \frac{\sin A}{\cos A}$ $= \frac{2p}{p}$ $= 2$ **OR/*OF***  $\tan A = \frac{2p}{p}$ $= 2$	✓identity ✓value of tan A (2) ✓ $\frac{y}{x}$ ✓value of tan A (2)
5.1.2	$\sin^2 A + \cos^2 A = 1$ $(2p)^2 + p^2 = 1$ $4p^2 + p^2 = 1$ $5p^2 = 1$ $p^2 = \frac{1}{5}$ $\therefore p = -\frac{1}{\sqrt{5}}$	✓ $(2p)^2 + p^2 = 1$ ✓ simplification of LHS ✓answer (3)
5.2	$2\sin^2 x - 5\sin x + 2 = 0$ $(2\sin x - 1)(\sin x - 2) = 0$ $\sin x = \frac{1}{2}$ or $\sin x = 2$(no solution) ref $\angle = 30°$ $\therefore x = 30° + k.360°$ or $x = 150° + k.360°$; $k \in Z$	✓ factors or formula ✓ both equations ✓ no solution/*geen opl* ✓ $30° + k.360°$ ✓ $150° + k.360°$; ✓ $k \in Z$ (6)
5.3.1	$\sin(x + 300°) = \sin x \cos 300° + \cos x \sin 300°$	✓ expansion/*uitbreiding* (1)
5.3.2	$\sin(x + 300°) - \cos(x - 150°)$ $= \sin x \cos 300° + \cos x \sin 300° - (\cos x \cos 150° + \sin x \sin 150°)$ $= \sin x \cos 60° - \cos x \sin 60° - (-\cos x \cos 30° + \sin x \sin 30°)$ $= \sin x \cos 60° - \cos x \sin 60° + \cos x \cos 30° - \sin x \sin 30°$ $= \frac{1}{2}\sin x - \frac{\sqrt{3}}{2}\cos x + \frac{\sqrt{3}}{2}\cos x - \frac{1}{2}\sin x$ $= 0$ **OR/*OF***	✓2^{nd} expansion/ *2de uitbreiding* ✓✓ reduction/*reduksie* ✓ special angle values/ *spesiale hoekwaardes* ✓ answer (5)

	$\sin(x+300°)-\cos(x-150°)$ $=\sin x\cos 300°+\cos x\sin 300°-(\cos x\cos 150°+\sin x\sin 150°)$ $=\sin x\cos 60°-\cos x\sin 60°-(-\cos x\cos 30°+\sin x\sin 30°)$ $=\sin x\cos 60°-\cos x\sin 60°+\cos x\cos 30°-\sin x\sin 30°$ $=\sin x\sin 30°-\cos x\sin 60°+\cos x\sin 60°-\sin x\sin 30°$ $=0$	✓2^{nd} expansion/ *2de uitbreiding* ✓✓ reduction/*reduksie* ✓ co-ratios / *ko-verh* ✓ answer (5)
5.4	Consider: $\dfrac{\tan x+1}{\sin x\tan x+\cos x}=\sin x+\cos x$ $\text{LHS}=\dfrac{\left(\dfrac{\sin x}{\cos x}+1\right)}{\left(\sin x.\dfrac{\sin x}{\cos x}+\cos x\right)}=\dfrac{\left(\dfrac{\sin x+\cos x}{\cos x}\right)}{\left(\dfrac{\sin^2 x+\cos^2 x}{\cos x}\right)}$ $=\dfrac{\dfrac{\sin x+\cos x}{\cos x}}{\dfrac{1}{\cos x}}$ $=\dfrac{\sin x+\cos x}{\cos x}\times\dfrac{\cos x}{1}$ $=\sin x+\cos x$ = RHS	✓ identity of tan x ✓ $\dfrac{\sin x+\cos x}{\cos x}$ ✓ $\dfrac{\sin^2 x+\cos^2 x}{\cos x}$ ✓ $\sin^2 x+\cos^2 x=1$ ✓ simplify (5)
	OR/*OF* $\text{LHS}=\dfrac{\left(\dfrac{\sin x}{\cos x}+1\right)}{\left(\sin x.\dfrac{\sin x}{\cos x}+\cos x\right)}=\dfrac{\left(\dfrac{\sin x}{\cos x}+1\right)}{\left(\dfrac{\sin^2 x+\cos^2 x}{\cos x}\right)}$ $=\dfrac{\left(\dfrac{\sin x}{\cos x}+1\right)}{\dfrac{1}{\cos x}}$ $=\left(\dfrac{\sin x}{\cos x}+1\right)\times\dfrac{\cos x}{1}$ $=\sin x+\cos x$ = RHS	✓ identity of tan x ✓ $\dfrac{\sin^2 x+\cos^2 x}{\cos x}$ ✓ $\sin^2 x+\cos^2 x=1$ ✓ simplify ✓ multiplication (5)
5.5.1	$\left(\sqrt{1+k}\right)^2=(\sin x+\cos x)^2$ $1+k=\sin^2 x+2\sin x\cos x+\cos^2 x$ $1+k=1+\sin 2x$ $k=\sin 2x$	✓ square both sides ✓ $\sin^2 x+\cos^2 x=1$ ✓ sin $2x$ (3)

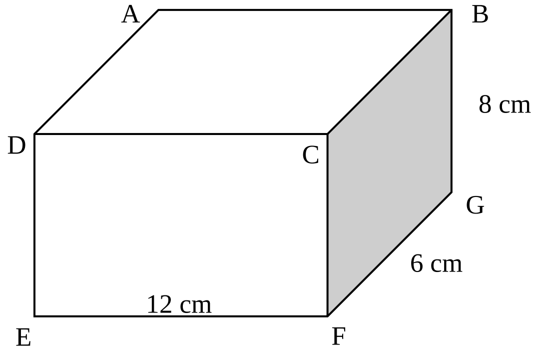
5.5.2	From 5.5.1 $\sin x + \cos x = \sqrt{1+\sin 2x}$ $\therefore$ max value: $\sin x + \cos x = \sqrt{1+1}$ $= \sqrt{2}$	✓ max of sin $2x$ =1 ✓ answer (2)
	OR/*OF*	
	Maximum value of 1 + sin $2x$ = 1 + 1 = 2 $\therefore$ maximum value of $\sin x + \cos x = \sqrt{2}$	✓ max of sin $2x$ =1 ✓ answer (2)
	OR/*OF* $(\sin x + \cos x)^2 = \sin^2 x + 2\sin x \cos x + \cos^2 x$ $= 1 + \sin 2x$ $\therefore$ max value $(\sin x + \cos x)^2 = 1 + 1 = 2$ $\therefore$ max value $\sin x + \cos x = \sqrt{2}$	✓ max of sin $2x$ =1 ✓ answer (2)
		[27]

QUESTION/VRAAG 6



6.1	Period = 180°	✓ answer (1)
6.2	$-75°$	✓ answer (1)
6.3	$\sin 2x \leq \frac{1}{\sqrt{2}}\cos x + \frac{1}{\sqrt{2}}\sin x$ $\sin 2x \leq \cos 45°.\cos x + \sin 45°.\sin x$ $\sin 2x \leq \cos(x - 45°)$ $x \in [-75° \;; 165°]$	✓ $\cos 45°.\cos x + \sin 45°.\sin x$ ✓ $\cos(x - 45°)$ ✓ ✓ answer (4)
		[6]

QUESTION/VRAAG 7



Figure/*Figuur* (i)

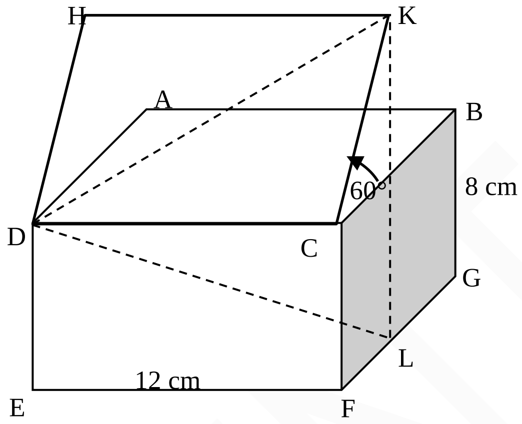
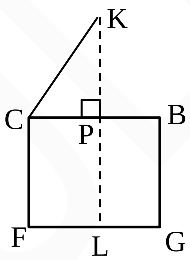


Figure / *Figuur* (ii)

7.1	KC = 6 cm	✓ answer (1)
7.2	Let P be the point of intersection of KL and CB $\frac{KP}{KC} = \sin 60°$ $KP = 6\sin 60°$ $KP = 3\sqrt{3}$ or 5,20 $\therefore KL = 8 + 3\sqrt{3}$ or 13,20 cm 	✓ trig ratio ✓ length of KP ✓ answer (3)
7.3	$DK^2 = 6^2 + 12^2$ $DK = \sqrt{180}$ or $6\sqrt{5}$ or 13,42 cm $\frac{\sin K\hat{D}L}{KL} = \frac{\sin D\hat{L}K}{DK}$ $\frac{\sin K\hat{D}L}{\sin D\hat{L}K} = \frac{KL}{DK}$ $= \frac{8+3\sqrt{3}}{6\sqrt{5}}$ or $\frac{13,20}{13,42}$ or 0,98	✓ $DK = 6\sqrt{5}$ ✓ use of sine rule ✓ $\frac{\sin K\hat{D}L}{\sin D\hat{L}K} = \frac{KL}{DK}$ ✓ answer (4) **[8]**

4.5	MT = diameter/*middellyn* [conv∠ in $\frac{1}{2}$ circle/*omgek ∠in $\frac{1}{2}$ sirkel*] radius $= \frac{\sqrt{146}}{2}$ units Centre of circle/*Middelpunt v sirkel* = Midpoint MT /*Middelpunt MT* $= \left(\frac{-11}{2};\frac{5}{2}\right)$ Equation of circle through S, T and M: $\left(x+\frac{11}{2}\right)^2+\left(y-\frac{5}{2}\right)^2=\frac{146}{4}$ **OR/*OF*** $\left(x+5\frac{1}{2}\right)^2+\left(y-2\frac{1}{2}\right)^2=\frac{73}{2}=6{,}04$	✓ radius of circle ✓ x value of M ✓ y value of M ✓ LHS of equation ✓ RHS of equation (5) **[19]**

QUESTION/*VRAAG* 5

5.1	$a=-1$ $b=2$	✓ answer ✓ answer (2)
5.2	$f(3x) = -\sin 3x$ Period of $f(3x)=\frac{360°}{3}$ $= 120°$ Answer only: Full marks	✓ $\frac{360°}{3}$ ✓ answer (2)
5.3	$x \in [90°\ ;\ 135°) \cup \{180°\}$ **OR/*OF*** $90° \leq x < 135°$ or $x = 180°$	✓ 90° and 135° in interval form ✓ 180° as single value ✓ correct brackets (3) ✓ 90° and 135° in interval form ✓ 180° as single value ✓ correct inequalities (3) **[7]**

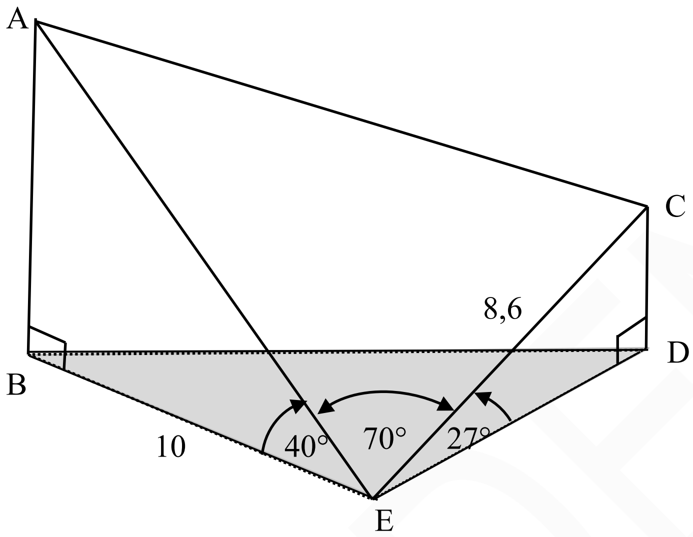
QUESTION/*VRAAG* 6

6.1.1	$\sin(360° - 36°) = -\sin 36°$	✓ answer (1)
6.1.2	$\cos 72° = \cos(2\times 36°)$ $= 1 - 2\sin^2 36°$ Answer only: Full marks	✓ double angle/*dubbelhoek* ✓answer (2)
6.2	R.T.P.: $1 - \dfrac{\tan^2\theta}{1+\tan^2\theta} = \cos^2\theta$ $\text{LHS} = \dfrac{1+\tan^2\theta - \tan^2\theta}{1+\tan^2\theta}$ $= \dfrac{1}{1+\dfrac{\sin^2\theta}{\cos^2\theta}}$ $= \dfrac{1}{\dfrac{\cos^2\theta+\sin^2\theta}{\cos^2\theta}}$ $= \dfrac{1}{\dfrac{1}{\cos^2\theta}}$ $= \cos^2\theta$ = RHS	✓ writing as a single fraction/*skryf as enkelbreuk* ✓ quotient identity/ *kwosiëntidentiteit* ✓ denominator as a single fraction / *Noemer as enkelbreuk* ✓ square identity/*vierkantidentiteit* (4)
	OR/*OF*	
	$\text{LHS} = \dfrac{1+\tan^2\theta - \tan^2\theta}{1+\tan^2\theta}$ $= \dfrac{1}{1+\dfrac{\sin^2\theta}{\cos^2\theta}}$ $= \dfrac{1}{1+\dfrac{\sin^2\theta}{\cos^2\theta}} \times \dfrac{\cos^2\theta}{\cos^2\theta}$ $= \dfrac{\cos^2\theta}{\cos^2\theta+\sin^2\theta}$ $= \dfrac{\cos^2\theta}{1}$ $= \cos^2\theta$ = RHS	✓ writing as a single fraction/*skryf as enkelbreuk* ✓ quotient identity / *kwosiëntidentiteit* ✓ $\times \dfrac{\cos^2\theta}{\cos^2\theta}$ ✓ square identity/*vierkantidentiteit* (4)
	OR/*OF*	✓ quotient identity/

	$\text{LHS} = 1 - \left(\frac{\sin^2\theta}{\cos^2\theta} \div \left(1 + \frac{\sin^2\theta}{\cos^2\theta}\right)\right)$ $= 1 - \left(\frac{\sin^2\theta}{\cos^2\theta} \times \frac{\cos^2\theta}{\cos^2\theta + \sin^2\theta}\right)$ $= 1 - \left(\frac{\sin^2\theta}{\cos^2\theta} \times \frac{\cos^2\theta}{1}\right)$ $= 1 - \sin^2\theta$ $= \cos^2\theta$ = RHS	*kwosiëntidentiteit* ✓ writing as a single fraction/ *skryf as enkelbreuk* ✓ square identity/*vierkantidentiteit* ✓ simplification/*vereenvoudiging* (4)
6.3	$\cos^2 \frac{1}{2}x = \frac{1}{4}$ $\cos\frac{1}{2}x = \frac{1}{2}$ *or* $-\frac{1}{2}$ $\frac{1}{2}x = 60° + k.360°$ or $\frac{1}{2}x = 300° + k.360°$ or $\frac{1}{2}x = 120° + k.360°$ or $\frac{1}{2}x = 240° + k.360°$ $x = 120° + k.720°$ or $x = 600° + k.720°$ or $x = 240° + k.720°$ or $x = 480° + k.720°$; $k \in Z$ **OR/*OF*** $\cos^2 \frac{1}{2}x = \frac{1}{4}$ $\cos\frac{1}{2}x = \frac{1}{2}$ *or* $-\frac{1}{2}$ $\frac{1}{2}x = \pm 60° + k.360°$ or $\frac{1}{2}x = \pm 120° + k.360°$ $x = \pm 120° + k.720°$ or $x = \pm 240° + k.720°$; $k \in Z$	✓✓ $\cos^2 \frac{1}{2}x = \frac{1}{4}$ ✓ 60° and 300° ✓ 120° and 240° ✓ write at least one general solution as $\frac{1}{2}x = \angle + k.360°$ ✓ write at least one general solution as $x = \angle + k.720°$; $k \in Z$ (6) ✓✓ $\cos^2 \frac{1}{2}x = \frac{1}{4}$ ✓ ±60° ✓±120° ✓ write at least one general solution as $\frac{1}{2}x = \angle + k.360°$ ✓ write at least one general solution as $x = \angle + k.720°$ $k \in Z$ (6)

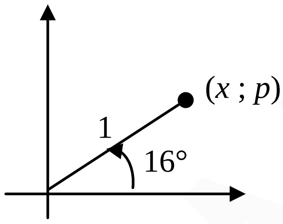
6.4.1	$\sin(A-B)=\cos[90°-(A-B)]$ $=\cos[(90°-A)-(-B)]$ $=\cos(90°-A)\cos(-B)+\sin(90°-A)\sin(-B)$ $=\sin A\cos B+\cos A(-\sin B)$ $=\sin A\cos B-\cos A\sin B$ **OR/*OF*** $\sin(A-B)=\cos[90°-(A-B)]$ $=\cos[(90°+B)-A]$ $=\cos(90°+B)\cos A+\sin(90°+B)\sin A$ $=-\sin B\cos A+\cos B\sin A$ $=\sin A\cos B-\cos A\sin B$	✓ co–ratio/*ko-verhouding* ✓ writing as a difference of A & B/ *skryf as verskil van A & B* ✓ expansion/*uitbreiding* ✓ all reductions/*alle reduksies* (4) ✓ co–ratio/*ko-verhouding* ✓ writing as a difference of A & B/ *skryf as verskil van A & B* ✓ expansion/*uitbreiding* ✓ all reductions/*alle reduksies* (4)
6.4.2	$\sin(x+64°)\cos(x+379°)+\sin(x+19°)\cos(x+244°)$ $=\sin(x+64°)\cos(x+19°)+\sin(x+19°)[-\cos(x+64°)]$ $=\sin(x+64°)\cos(x+19°)-\cos(x+64°)\sin(x+19°)$ $=\sin[x+64°-(x+19°)]$ $=\sin 45°$ $=\frac{1}{\sqrt{2}}$	✓ $\cos(x+379°)=\cos(x+19°)$ ✓✓ $\cos(x+244°)=-\cos(x+64°)$ ✓✓compound formula identity/ *saamgestelde identiteit* ✓ $\sin 45°$ (6) **[23]**

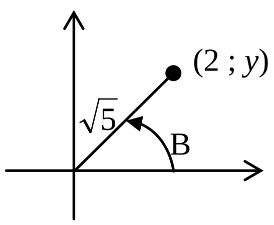
QUESTION/*VRAAG* 7



7.1	$\sin 27° = \frac{CD}{8,6}$ $CD = 8,6\sin 27°$ $CD = 3,90$ m	✓ substitution in correct trig ratio / *substitusie in korrekte trig verh* ✓ answer (2)
7.2	$\cos 40° = \frac{10}{AE}$ $AE = \frac{10}{\cos 40°}$ $AE = 13,05$ m	✓ substitution in correct trig ratio / *substitusie in korrekte trig verh* ✓ answer (2)
7.3	$AC^2 = CE^2 + AE^2 - 2\,CE.AE(\cos A\hat{E}C)$ $= (8,6)^2 + (13,05)^2 - 2(8,6)(13,05)(\cos 70°)$ $= 167,49$ $AC = 12,94$ m	✓ correct use of cosine rule in ΔACE/ *korrekte gebruik van reel in* ΔACE ✓ correct subst into cosine rule ✓ AC^2 ✓ answer (4) **[8]**

QUESTION/*VRAAG* 5

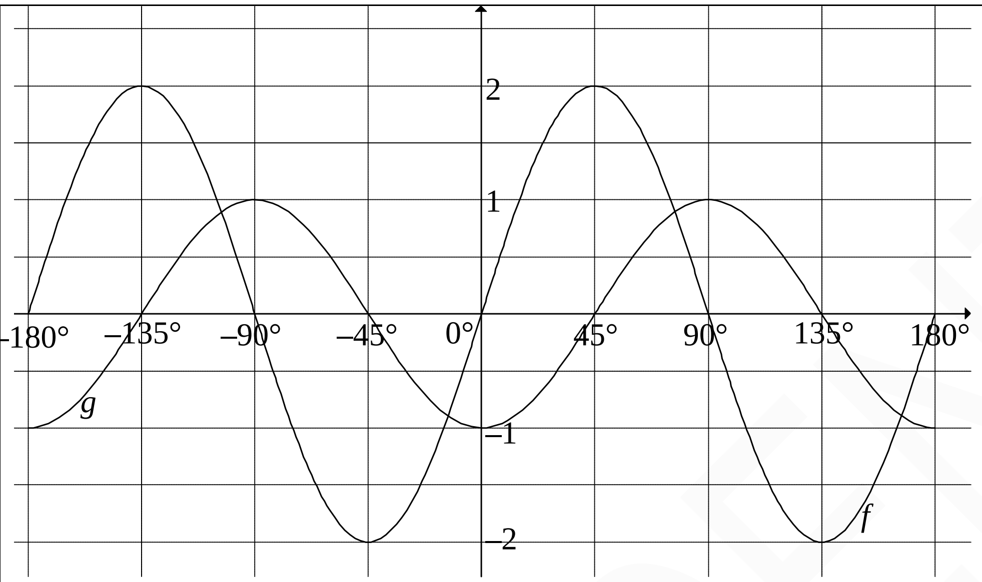
5.1.1	$\sin 196° = -\sin 16°$ $= -p$	✓reduction ✓answer (2)
5.1.2	$\cos 16° = \sqrt{1-\sin^2 16°}$ $= \sqrt{1-p^2}$ **OR/*OF***  $x^2 + p^2 = 1$ $x = \sqrt{1-p^2}$ $\therefore\ \cos 16° = \frac{\sqrt{1-p^2}}{1} = \sqrt{1-p^2}$	✓statement ✓answer (2) ✓x in terms of p ✓answer (2)
5.2	$\sin(A+B) = \cos[90° - (A+B)]$ $= \cos[(90° - A) - B]$ $= \cos(90° - A)\cos B + \sin(90° - A)\sin B$ $= \sin A\cos B + \cos A\sin B$	✓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**	✓ $\sqrt{\sin^2 2A}$ ✓ cosA ✓ – sinA ✓ 2sinAcosA ✓ answer (5) ✓ $2\cos^2 A - 1$ ✓ cosA ✓ – sinA ✓identity ✓ answer (5)

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

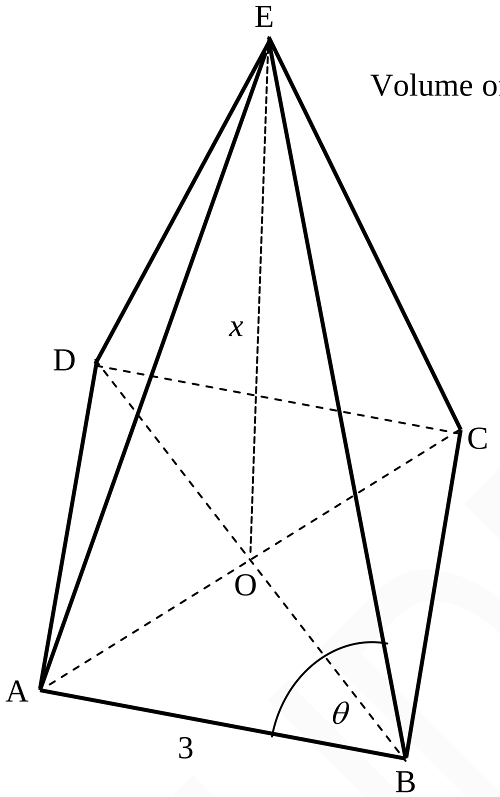
 Please turn over/*Blaai om asseblief*

	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/*VRAAG* 6

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]**

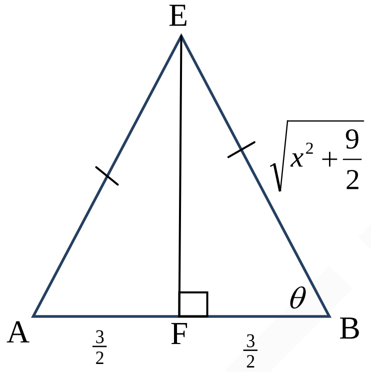
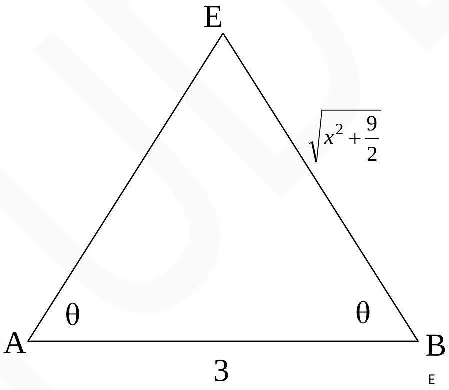
QUESTION/*VRAAG* 7



$$\text{Volume of pyramid} = \frac{1}{3}(\text{area of base}) \times (\perp \text{ height})$$

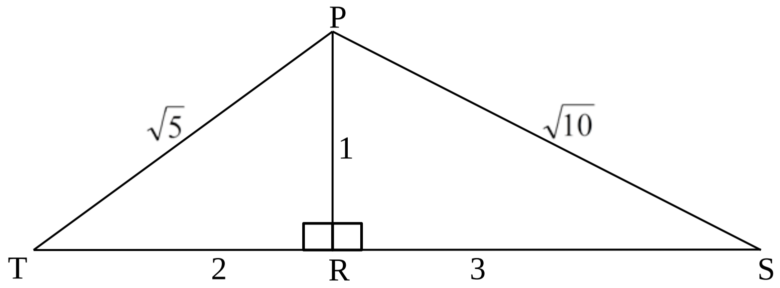
7.1	$DB^2 = 3^2 + 3^2$ [Theorem of Pyth] $= 18$ $DB = \sqrt{18}$ $OB = \frac{1}{2}DB = \frac{\sqrt{18}}{2}$ or $\frac{3}{\sqrt{2}}$ or $\frac{3\sqrt{2}}{2}$ or $2{,}12$ **OR/*OF*** $\sin 45° = \frac{OB}{3}$ $OB = 3\sin 45°$ $OB = \frac{3\sqrt{2}}{2}$ or $\frac{3}{\sqrt{2}}$ or $2{,}12$ **OF/OR** $\cos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

	OR/OF $\hat{AOB} = 90°$ (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] $\cos\theta = \frac{AB}{2EB}$ $\cos\theta = \frac{3}{2\sqrt{x^2 + \frac{9}{2}}}$	✓ substitution into Pyth ✓ length of BE ✓correct cosine rule ✓ cos θ as subject ✓ simplification (5)
	OR/*OF* $BE^2 = EO^2 + OB^2$ (Pyth) $BE^2 = x^2 + \left(\frac{3}{\sqrt{2}}\right)^2$ $BE = \sqrt{x^2 + \frac{9}{2}}$ $AE^2 = AB^2 + EB^2 - 2AB.EB\cos\theta$ $\left(\sqrt{x^2 + \frac{9}{2}}\right)^2 = 9 + \left(\sqrt{x^2 + \frac{9}{2}}\right)^2 - 2(3)\left(\sqrt{x^2 + \frac{9}{2}}\right).\cos\theta$ $\cos\theta = \frac{9}{6\sqrt{x^2 + \frac{9}{2}}}$ $= \frac{3}{2\sqrt{x^2 + \frac{9}{2}}}$	s ✓ substitution into Pyth ✓ length of BE ✓correct cosine rule ✓ substituting ✓ cos θ as subject (5)

	OR/*OF* $\text{BE}^2 = \text{EO}^2 + \text{OB}^2$ (Pyth) $\text{BE}^2 = x^2 + \left(\frac{3}{\sqrt{2}}\right)^2$ $\text{BE} = \sqrt{x^2 + \frac{9}{2}}$ $\cos\theta = \frac{\frac{3}{2}}{\sqrt{x^2+\frac{9}{2}}}$ $= \frac{3}{2\sqrt{x^2+\frac{9}{2}}}$ 	✓ 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/*VRAAG* 5

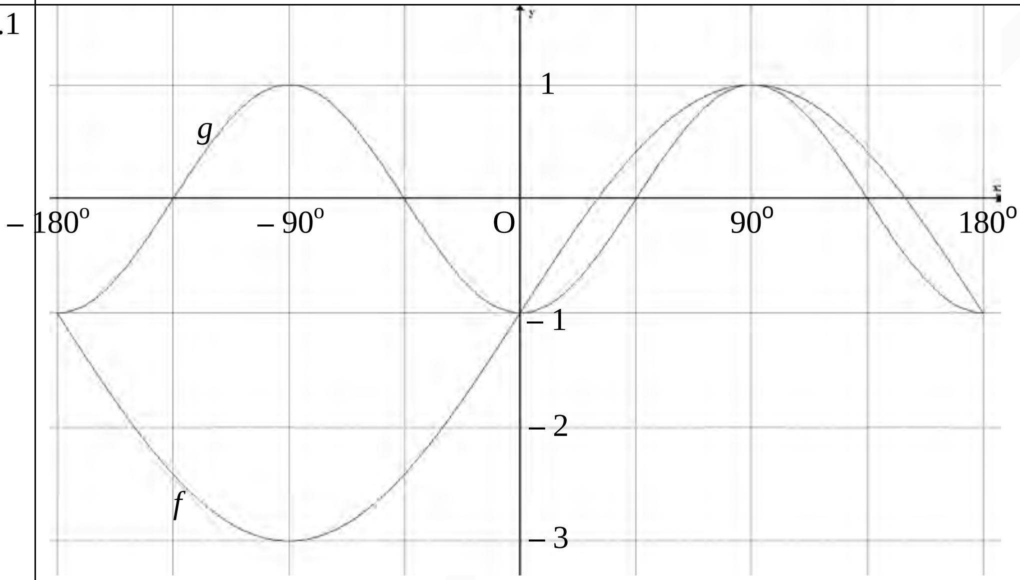
5.1



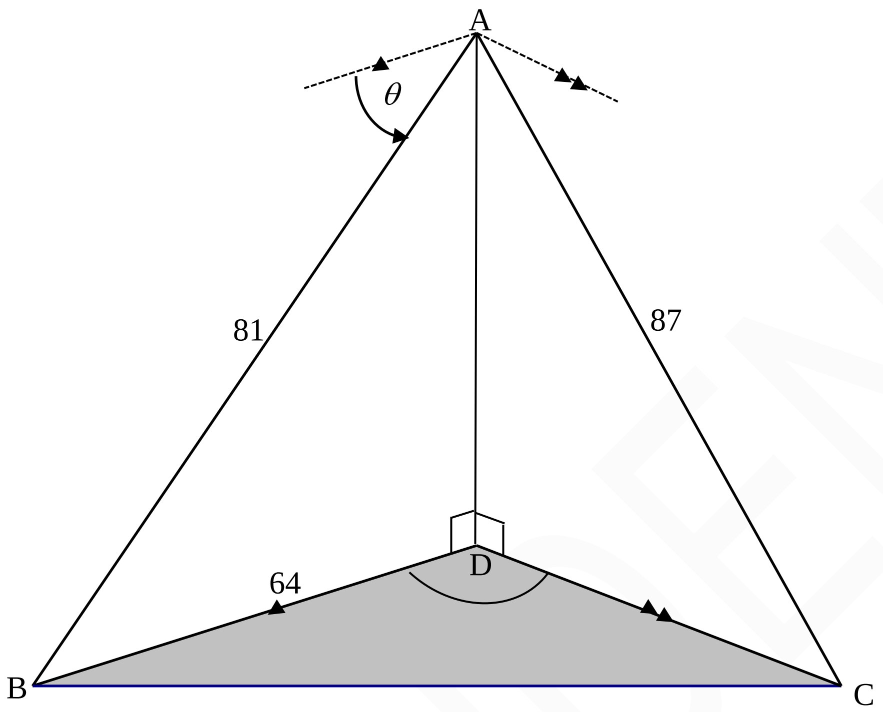
5.1.1(a)	$\sin T = \frac{1}{\sqrt{5}} = \frac{\sqrt{5}}{5} = 0{,}45$	✓value (1)
5.1.1(b)	$\cos S = \frac{3}{\sqrt{10}} = \frac{3\sqrt{10}}{10} = 0{,}95$	✓value (1)
5.1.2	$\cos(T+S) = \cos T\cos S - \sin T\sin S$ $= \left(\frac{2}{\sqrt{5}}\right)\left(\frac{3}{\sqrt{10}}\right) - \left(\frac{1}{\sqrt{5}}\right)\left(\frac{1}{\sqrt{10}}\right)$ $= \frac{6}{\sqrt{50}} - \frac{1}{\sqrt{50}}$ $= \frac{5}{\sqrt{50}}$ *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/*VRAAG* 6

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]**

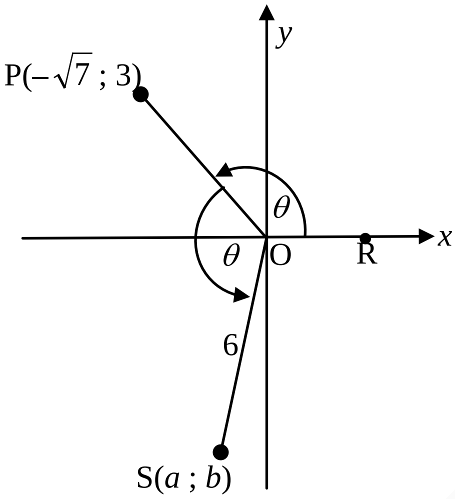
QUESTION/*VRAAG* 7



7.1	$\hat{ABD} = \theta$ [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]**

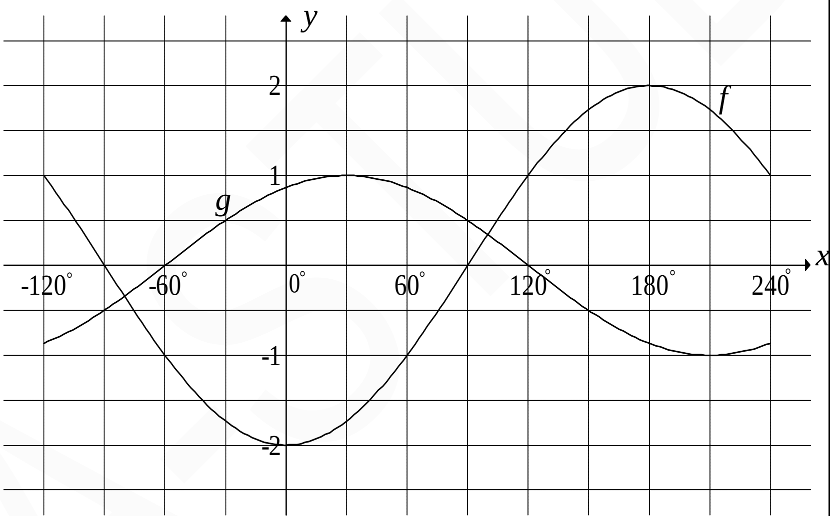
QUESTION/*VRAAG* 5



5.1.1	$\tan\theta = -\frac{3}{\sqrt{7}}$	✓answ/*antw* (1)
5.1.2	$\sin(-\theta) = -\sin\theta$ $OP^2 = \left(-\sqrt{7}\right)^2 + 3^2$ $OP^2 = 16$ $OP = 4$ $\sin(-\theta) = -\frac{3}{4}$	✓reduction/ *reduksie* ✓ 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 2*x* ✓–cos 2*x* ✓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/*VRAAG* 6

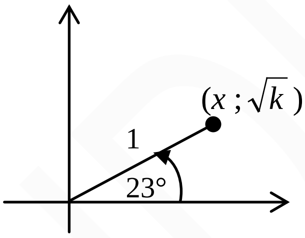
6.1	sin (x + 60°) + 2cos x = 0 sin x cos 60° + cos x sin 60° + 2cos x = 0 $\frac{1}{2}\sin x + \frac{\sqrt{3}}{2}\cos x + 2\cos x = 0$ $\frac{1}{2}\sin x = -2\cos x - \frac{\sqrt{3}}{2}\cos x$ $\sin x = -4\cos x - \sqrt{3}\cos x$ $\sin x = \cos x(-4-\sqrt{3})$ $\frac{\sin x}{\cos x} = \frac{\cos x(-4-\sqrt{3})}{\cos x}$ $\therefore \tan x = -4-\sqrt{3}$	✓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* ∠ = 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	∴ sin (x + 60°) > –2cos x x ∈ (–80,10° ; 99,90°) **OR/*OF*** $-80{,}10° < x < 99{,}90°$	✓✓critical values/ *kritiese waardes* ✓notation/*notasie* (3) **[13]**

QUESTION/*VRAAG* 7

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 **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	✓$(\text{Area } \Delta PQR)' = 0$ ✓$5\sqrt{3} - 2\sqrt{3}x$ ✓answ/*antw* (3) ✓formula/*e* ✓ subst ✓answ/*antw* (3) ✓*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* $A\hat{D}B = 90° - \beta$ [∠s of/*v* Δ = 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°– β) = cos β ✓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 = 2*h*	✓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* (7)
	OR/*OF* Split isosceles triangle ABQ into two congruent triangles AEB and DEB. Then ΔABC ≡ ΔBAE (AB = AC, $A\hat{B}E = B\hat{A}C = \beta$, *h*) $\therefore$ AE = ED = BC = *h* $\therefore$ AD = 2*h*	(7)
		[15]

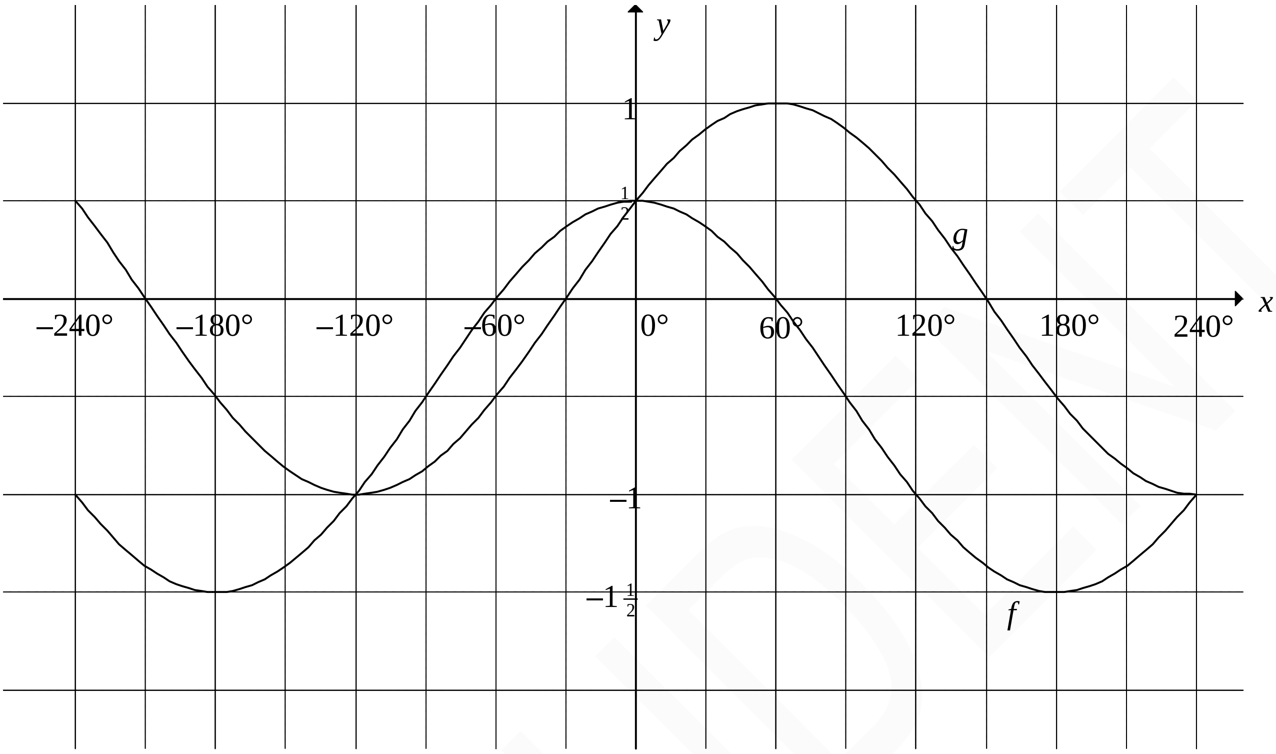
QUESTION/*VRAAG* 5

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

	OR/OF $\dfrac{4\cos x.(-\sin x)}{(\sin 30°\cos x-\cos 30°\sin x)\cos x+(\cos 30°\cos x+\sin 30°\sin x)\sin x}$ $=\dfrac{-4\sin x.\cos x}{(\frac{1}{2}\cos x-\frac{\sqrt{3}}{2}\sin x)\cos x+(\frac{\sqrt{3}}{2}\cos x+\frac{1}{2}\sin x)\sin x}$ $=\dfrac{-2(2\sin x.\cos x)}{\frac{1}{2}\cos^2 x+\frac{1}{2}\sin^2 x}$ $=\dfrac{-2(2\sin x.\cos x)}{\frac{1}{2}(\cos^2 x+\sin^2 x)}$ $=\dfrac{-2(2\sin x.\cos x)}{\frac{1}{2}(1)}$ $=-8\cos x\sin x$ $=-4(2\sin x\cos x)$ $=-4\sin 2x$	✓ $\cos x$ ✓ $-\sin x$ ✓ $\frac{1}{2}\cos^2 x+\frac{1}{2}\sin^2 x$ ✓ $\frac{1}{2}$ ✓ 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) $\therefore x = 120° + n.360°$ or/*of* $x = 240° + n.360°$; $n \in Z$ **OR/OF** $\therefore x = \pm 120° + n.360°$; $n \in Z$	✓ expansion/ *uitbreiding* ✓ $2\cos^2 x - 7\cos x - 4 = 0$ ✓ factors/*faktore* ✓ $\cos x = -\frac{1}{2}$ ✓ 120° & 240° ✓ + n.360° **OR/OF** ✓ ±120° ✓ + n.360° (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]**

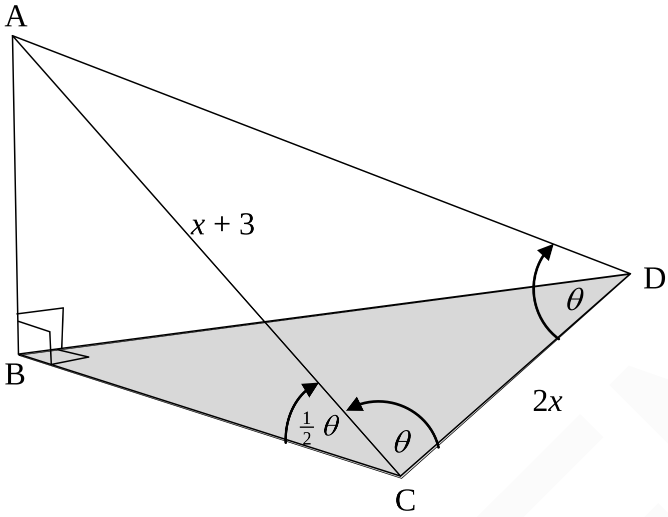
QUESTION/*VRAAG* 6

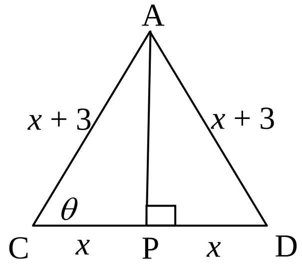


6.1	$f(x) = \cos x - \frac{1}{2}$ and/*en* $g(x) = \sin(x + 30°)$ $\therefore\ p = 30°$ and/*en* $q = -\frac{1}{2}$ **OR/*OF*** $\sin(60° + p) = 1$ and/*en* $\cos 0° + q = \frac{1}{2}$ $\therefore\ p = 30°$ $\therefore\ q = -\frac{1}{2}$	✓ $f(x) = \cos x - \frac{1}{2}$ ✓ $g(x) = \sin(x + 30°)$ ✓ value 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.*	✓ 60° left/*links* ✓ reflection about x-axis/*refleksie om x-as* (2)
	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.*	✓ reflection about x-axis/*refleksie om x-as* ✓ 60° left/*links* (2)
	OR/*OF* The graph of g has to shift 120° to the right./*Die grafiek van g moet 120° na regs geskuif word.*	✓ ✓ 120° right/*regs* (2)
	OR/*OF* The graph of g has to shift 240° to the left./*Die grafiek van g moet met 240° na links geskuif word*	✓ ✓ 240° left/*links* (2) **[8]**

QUESTION/*VRAAG* 7



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 2θ ✓ 2 sinθ. cos θ ✓ cos θ 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 θ 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	$\cos\theta = \frac{2}{5}$ $\therefore \quad \theta = 66{,}42°$ In ΔABC: $\sin \frac{1}{2}\theta = \frac{AB}{AC}$ $\sin 33{,}21° = \frac{AB}{5}$ $\therefore \quad AB = 5 \sin 33{,}21°$ $= 2{,}74$ **OR/*OF*** $\sin \frac{\theta}{2} = \frac{AB}{5}$ $\therefore AB = 5 \sin \frac{\theta}{2}$ but/*maar*: $\cos\theta = \frac{2}{5}$ $1 - 2\sin^2 \frac{\theta}{2} = \frac{2}{5}$ $\sin^2 \frac{\theta}{2} = \frac{3}{10}$ $\sin \frac{\theta}{2} = \sqrt{\frac{3}{10}}$ $\therefore AB = 5\sqrt{\frac{3}{10}} = \sqrt{\frac{15}{2}} = 2{,}74$	✓ $\cos\theta = \frac{2}{5}$ ✓ size of/*grootte v* θ ✓ correct ratio/ *korrekte verh* ✓ subst correctly/ *korrek* ✓ answ/*antw* (5) ✓ $AB = 5 \sin \frac{\theta}{2}$ ✓ equation/*vgl* ✓ simplification/ *vereenvoudiging* ✓ value of/*waarde v* $\sin \frac{\theta}{2}$ ✓ answ/*antw* (5) **[10]**

QUESTION/VRAAG 5

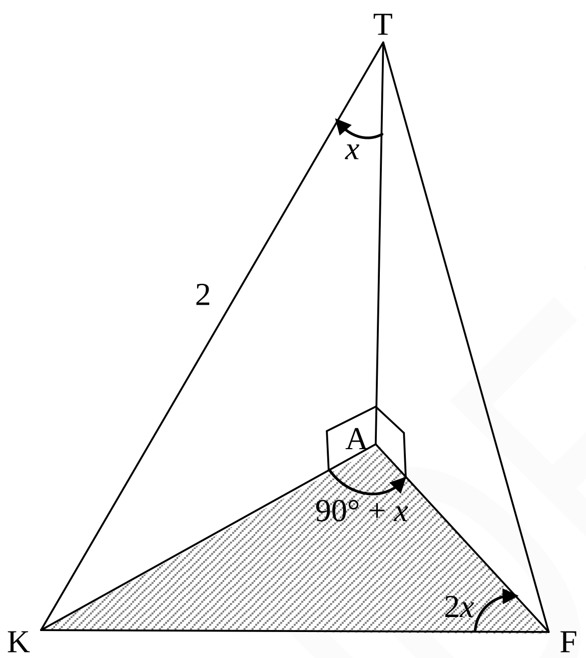
5.1	$x^2 + y^2$ $=(3\sin\theta)^2 + (3\cos\theta)^2$ $=9\sin^2\theta + 9\cos^2\theta$ $=9(\sin^2\theta + \cos^2\theta)$ $=9(1)$ $=9$	✓ simpl/*vereenv* ✓ CF/*GF* = 9 ✓ answer/*antw* (3)
5.2	$\sin(540° - x).\sin(-x) - \cos(180° - x).\sin(90° + x)$ $\sin(180° - x).\sin(-x) - \cos(180° - x).\sin(90° + x)$ $= (\sin x)(-\sin x) - (-\cos x)(\cos x)$ $= -\sin^2 x + \cos^2 x$ $= \cos 2x$	✓ $\sin(540° - x) = \sin x$ ✓ $\sin(-x) = -\sin x$ ✓ $\cos(180° - x) = -\cos x$ ✓ $\sin(90° + x) = \cos x$ ✓ $-\sin^2 x + \cos^2 x$ ✓ $\cos 2x$ (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*: $2\sin^2 x = 0$ $\therefore$ <u>$\sin x = 0$:</u> $x = 0°$; $180°$ or/*of* <u>$\tan x = \infty$:</u> $x = 90°$ $\therefore$ $x = 0°$; $90°$; $180°$	✓ $x = 0°$ ✓ $x = 90°$ ✓ $x = 180°$ (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/VRAAG 6

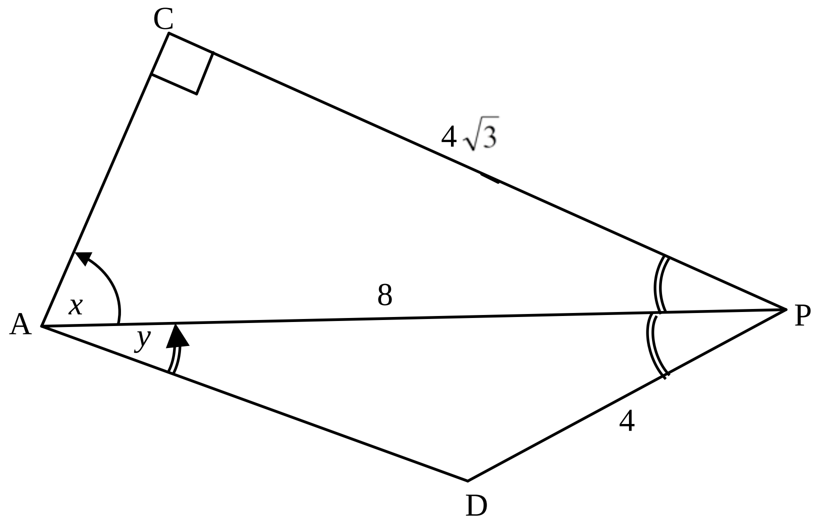
6.1



6.1.1	In ΔTAK: $\frac{AK}{KT} = \sin K\hat{T}A$ $AK = KT.\sin x$ $= 2\sin x$ **OR/*OF*** $\frac{\sin K\hat{T}A}{AK} = \frac{\sin K\hat{A}T}{KT}$ $\frac{\sin 90^\circ}{2} = \frac{\sin x}{AK}$ $AK = 2\sin x$	✓ 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: $\frac{KF}{\sin K\hat{A}F} = \frac{AK}{\sin A\hat{F}K}$ $\frac{KF}{\sin(90° + x)} = \frac{AK}{\sin 2x}$ $KF = \frac{AK.\sin(90° + x)}{\sin 2x}$ $= \frac{2\sin x.\cos x}{2\sin x.\cos x}$ $= 1$	✓ using sine rule/ *gebruik sin-reël* ✓ correct subst into sine rule/*korrekte subst in sin-reël* ✓ sin(90° +*x*) = cos *x* ✓ 2sin*x*.cos*x* ✓ 1 (5)
	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* ✓ 2sin*x*.cos*x* ✓ 1 (5)

QUESTION/VRAAG 5



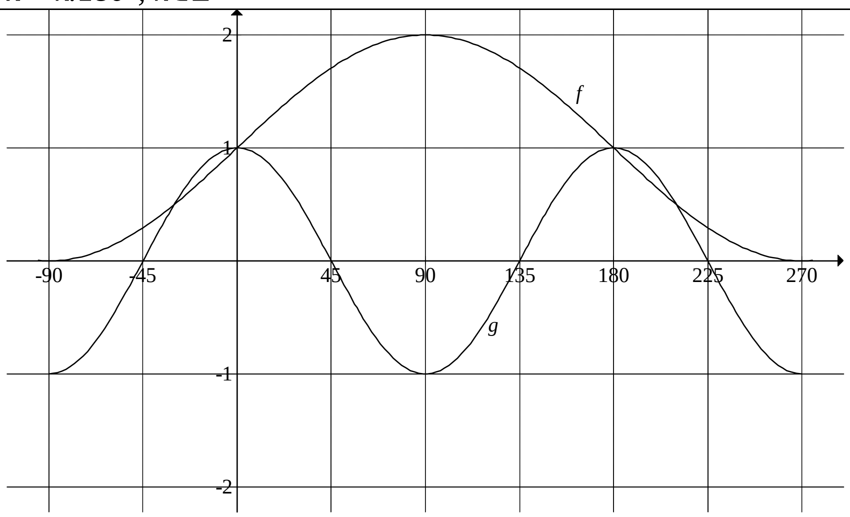
5.1	$\sin C\hat{A}P = \frac{CP}{AP}$ $\sin x = \frac{4\sqrt{3}}{8} = \frac{\sqrt{3}}{2}$ $x = 60°$ OR/OF $\frac{\sin 90°}{8} = \frac{\sin x}{4\sqrt{3}}$ $\sin x = \frac{4\sqrt{3}}{8} = \frac{\sqrt{3}}{2}$ $x = 60°$	✓ correct sine ratio/ *korrekte sin-verh* ✓ $\frac{\sqrt{3}}{2}$ (2) ✓ correct sine ratio/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

QUESTION/VRAAG 6

6.1	$\cos^2(180°+x)+\tan(x-180°)\sin(720°-x)\cos x$ $= (-\cos x)^2 + [-(-\tan x)](-\sin x)(\cos x)$ $= \cos^2 x + \left(\dfrac{\sin x}{\cos x}\right)(-\sin x)(\cos x)$ $= \cos^2 x - \sin^2 x$ $= \cos 2x$	✓ $(-\cos x)^2$ or $\cos^2 x$ ✓ $\tan x$ or $-(-\tan x)$ ✓ $-\sin x$ ✓ $\tan x = \dfrac{\sin x}{\cos x}$ ✓ $\cos^2 x - \sin^2 x$ (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/VRAAG 7

7.1	$0 \leq y \leq 2$ 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]**

APPARENTLY, THERE ISN'T A MEMO FOR THE 2014 EXEMPLAR, DON'T ASK WHY, I'M CERTAIN IT EXISTS SOMEWHERE JUST CAN'T FIND IT. BUT IF YOU'VE DONE ALL THE PAPERS THUS FAR YOU SHOULD BE GOOD WITHOUT THIS MEMO. (TRUST ME BRO) :)