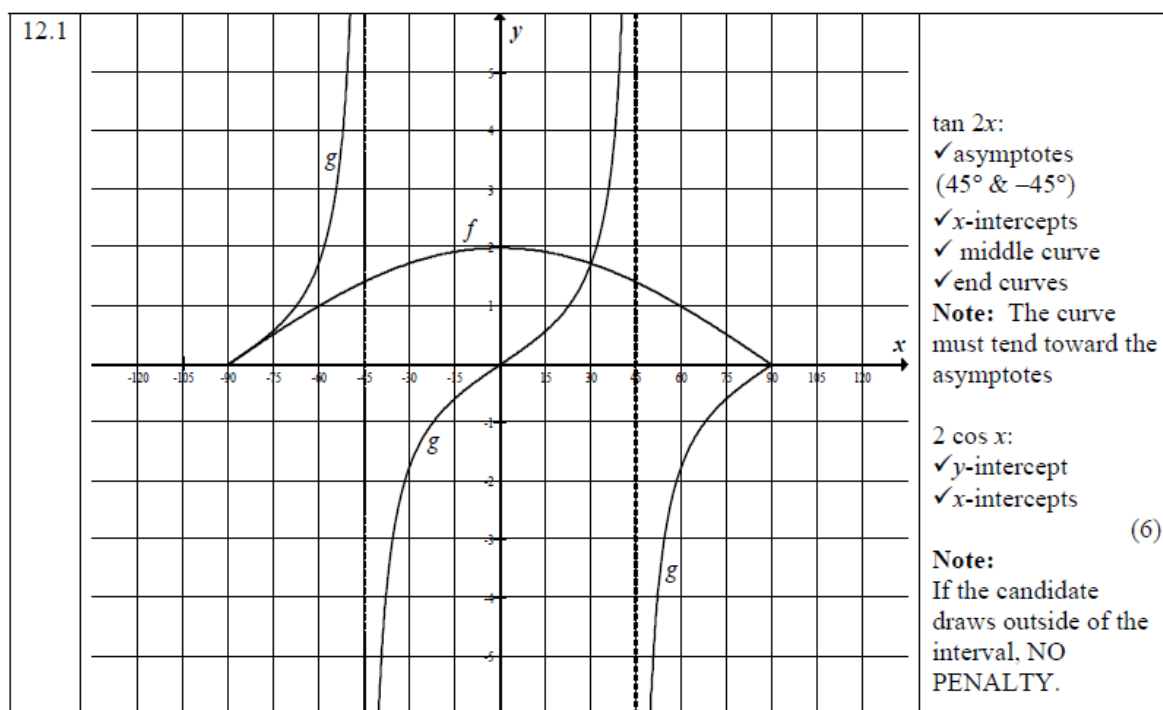


Graphs of Trigonometric Functions Memo

2010 November Paper 2 Q 12

QUESTION 12



12.2	For these values of x, $\cos 2x \neq 0$ $2 \cos x = \frac{\sin 2x}{\cos 2x}$ $= \frac{2 \sin x \cos x}{1 - 2 \sin^2 x}$ $1 - 2 \sin^2 x = \sin x \text{ or } \cos x = 0$ $2 \sin^2 x + \sin x - 1 = 0 \text{ or } \cos x = 0$ $(\sin x + 1)(2 \sin x - 1) = 0$ $\sin x = -1 \text{ or } \sin x = \frac{1}{2} \text{ or } \cos x = 0$ $x = \pm 90^\circ \text{ or } x = 30^\circ$ OR For these values of x, $\cos 2x \neq 0$ $2 \cos x = \frac{\sin 2x}{\cos 2x}$ $= \frac{2 \sin x \cos x}{2 \cos^2 x - 1}$ $2 \cos x(2 \cos^2 x - 1) = 2 \sin x \cos x$ $2 \cos x(2(1 - \sin^2 x) - 1) = 2 \sin x \cos x$ $2 \cos x(1 - 2 \sin^2 x) - 2 \sin x \cos x = 0$ $2 \cos x(2 \sin^2 x + \sin x - 1) = 0$ $2 \sin^2 x + \sin x - 1 = 0 \text{ or } \cos x = 0$ $(\sin x + 1)(2 \sin x - 1) = 0$ $\sin x = -1 \text{ or } \sin x = \frac{1}{2} \text{ or } \cos x = 0$ $x = \pm 90^\circ \text{ or } x = 30^\circ$	✓ $\frac{\sin 2x}{\cos 2x}$ ✓ $2 \sin x \cos x$ ✓ $1 - 2 \sin^2 x$ ✓ $\cos x = 0$ ✓ factors ✓ equations ✓ $\pm 90^\circ$ ✓ 30° (8) ✓ $\frac{\sin 2x}{\cos 2x}$ ✓ $2 \sin x \cos x$ ✓ $2 \cos^2 x - 1$ ✓ $\cos x = 0$ ✓ factors ✓ equations ✓ $\pm 90^\circ$ ✓ 30° (8)
-------------	---	--

	OR $2 \cos x = \frac{\sin 2x}{\cos 2x}$ $2 \cos x \cdot \cos 2x = \sin 2x$ $2 \cos x \cdot \cos 2x - 2 \sin x \cdot \cos x = 0$ $2 \cos x (\cos 2x - \sin x) = 0$ $\cos 2x = \sin x \quad \text{or} \quad 2 \cos x = 0$ $1 - 2 \sin^2 x = \sin x$ $2 \sin^2 x + \sin x - 1 = 0$ $(\sin x + 1)(2 \sin x - 1) = 0$ $\sin x = -1 \quad \text{or} \quad \sin x = \frac{1}{2} \quad \text{or} \quad \cos x = 0$ $x = \pm 90^\circ \quad \text{or} \quad x = 30^\circ$	$\checkmark \frac{\sin 2x}{\cos 2x}$ $\checkmark 2 \sin x \cos x$ $\checkmark 1 - 2 \sin^2 x$ $\checkmark \cos x = 0$ $\checkmark$ factors $\checkmark$ equations $\checkmark \pm 90^\circ$ $\checkmark 30^\circ$
		(8)
	OR $2 \cos x = \frac{\sin 2x}{\cos 2x}$ $2 \cos x \cdot \cos 2x = \sin 2x$ $2 \cos x \cdot \cos 2x - 2 \sin x \cdot \cos x = 0$ $2 \cos x (\cos 2x - \sin x) = 0$ $\cos 2x = \sin x \quad \text{or} \quad 2 \cos x = 0$ $\cos 2x = \cos(90^\circ - x) \quad x = 90^\circ$ $2x = \pm(90^\circ - x) + k \cdot 360^\circ \quad k \in \mathbb{Z}$ $3x = 90^\circ + k \cdot 360^\circ$ $x = 30^\circ + k \cdot 120^\circ$ $x = -90^\circ \quad \text{or} \quad x = 30^\circ$ or $x = -90^\circ + k \cdot 360^\circ$ $x = -90^\circ$	$\checkmark \frac{\sin 2x}{\cos 2x}$ $\checkmark 2 \sin x \cos x$ $\checkmark \sin x = \cos(90^\circ - x)$ $\checkmark \cos x = 0$ $\checkmark$ factors $\checkmark$ equations $\checkmark \pm 90^\circ$ $\checkmark 30^\circ$
12.3	$0^\circ < x < 45^\circ$ Or $-90^\circ < x < -45^\circ$	$\checkmark \checkmark$ critical points $\checkmark \checkmark$ notation (4)
12.4	Period = $2(360^\circ) = 720^\circ$	$\checkmark \checkmark$ answer (2)
12.5	$x = -45^\circ + 25^\circ = -20^\circ$ $x = 45^\circ + 25^\circ = 70^\circ$ OR $2(x - 25^\circ) = -90^\circ \quad 2(x - 25^\circ) = 90^\circ$ $2x - 50^\circ = -90^\circ \quad \text{and} \quad 2x - 50^\circ = 90^\circ$ $2x = -40^\circ \quad 2x = 140^\circ$ $x = -20^\circ \quad x = 70^\circ$	Note: Answer only: full marks $\checkmark x = -20^\circ$ $\checkmark x = 70^\circ$ (2)
		[22]

2016 June Eastern Cape Paper 2 Q 6

QUESTION/VRAAG 6

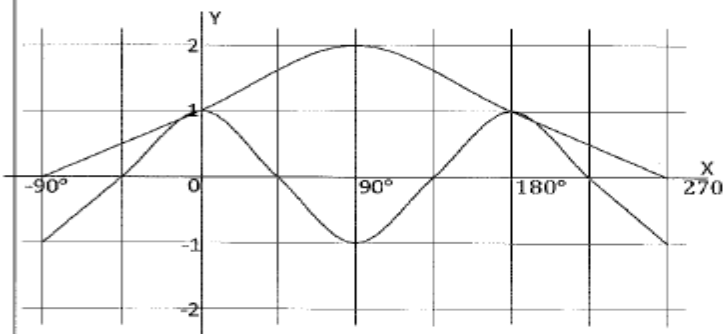
6.1		✓ shape g vorm g ✓ intercepts afsnitte ✓ min & max value/waarde ✓ shape f vorm f ✓ asymptotes asimptote ✓ intercept afsnit	(6)
6.2	$-180^\circ < x \leq -90^\circ$ or/of $0^\circ \leq x \leq 90^\circ$	✓ critical values / kritieke waardes ✓ notation / <i>notasie</i>	(2)

2014 March Paper 2 Q 9

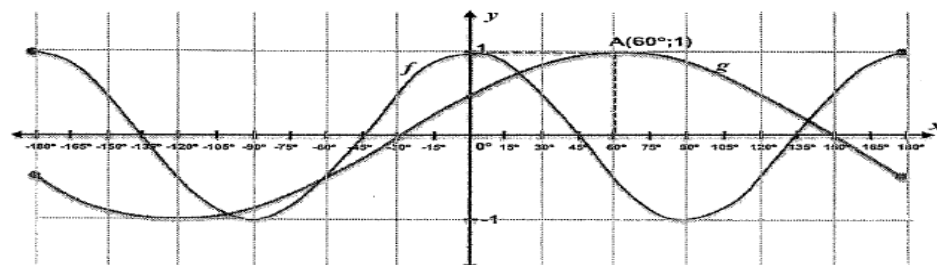
QUESTION/VRAAG 9

9.1	$\cos(x - 45^\circ) = -2 \sin x$ $\cos x \cos 45^\circ + \sin x \sin 45^\circ = -2 \sin x$ $\frac{\sqrt{2}}{2} \cos x + \frac{\sqrt{2}}{2} \sin x = -2 \sin x$ $\sqrt{2} \cos x = (-4 - \sqrt{2}) \sin x$ $\sqrt{2} = \frac{(-4 - \sqrt{2}) \sin x}{\cos x}$ $\tan x = \frac{\sqrt{2}}{-4 - \sqrt{2}} = -0,2612$	✓ expansion ✓ $\frac{\sqrt{2}}{2}$ ✓ simplification ✓ dividing by $\cos x$	(4)
9.2	$\tan x = -0,2612...$ $x = 165,36^\circ + 180^\circ k; k \in \mathbb{Z}$ $x = -14,64^\circ$ or $165,36^\circ$	✓ general solution ✓ ✓ values of x	(3)
9.3	T (135° ; 0)	✓ x value ✓ y value	(2)
9.4	$f(x) \geq g(x)$ $-14,64^\circ \leq x \leq 165,36^\circ$ OR $x \in [-14,64^\circ ; 165,36^\circ]$	✓ extreme values ✓ notation	(2)
9.5	$-135^\circ < x < -90^\circ$ OR $x \in (-135^\circ ; -90^\circ)$	✓ ✓ extreme values ✓ notation	(3)
9.6	$h(x) = \cos(x - 45^\circ - 45^\circ)$ $= \cos(x - 90^\circ)$ $= \sin x$ Answer only: full marks	✓ $\cos(x - 90^\circ)$ ✓ $\sin x$	(2) [16]

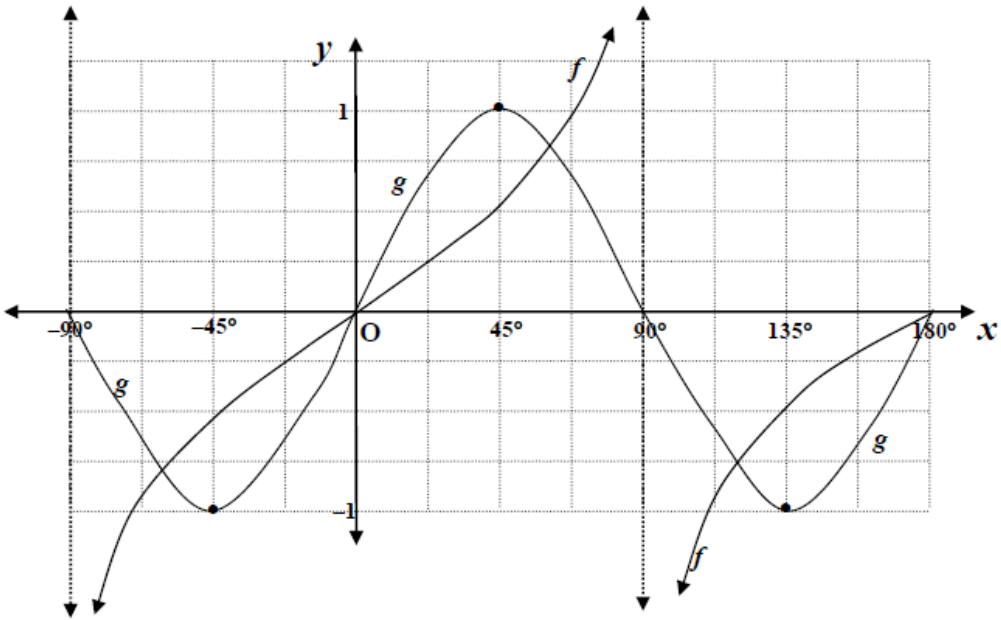
2015 Mpumalanga Prelim Paper 2 Q 6

6.1	$\sin x = \cos 2x - 1$ $\sin x = 1 - 2\sin^2 x - 1$ $2\sin^2 x + \sin x = 0$ $\sin x(2\sin x + 1) = 0$ $\sin x = 0$ or $\sin x = -\frac{1}{2}$ $x = k.180^\circ$ or $x = 180^\circ + 30^\circ + k.360^\circ$ $x = 210^\circ + k.360^\circ$ or $x = 360^\circ - 30^\circ + k.360^\circ$ $x = 330^\circ + k.360^\circ$ $x \in [-30^\circ; 0^\circ; 180^\circ; 210^\circ]$	✓ double angle formula ✓ factors ✓ $\sin x = 0$ or $\sin x = -\frac{1}{2}$ ✓ $x = k.180^\circ$ ✓ values 210° and 330° ✓✓ answers (7)
6.2		$f(x) = \sin x + 1$: ✓ x-intercept ✓ y-intercept ✓ turning point $g(x) = \cos 2x$: ✓ x-intercept ✓ y-intercept ✓ turning point (6)
6.3	$x = [-90^\circ; -45^\circ] \cup [45^\circ; 135^\circ] \cup [225^\circ; 270^\circ]$	✓✓✓ answer (3)

2015 Gauteng Prelim Paper 2 Q 7

		
7.1	$\sin(60^\circ - \theta) = 1$ $60^\circ - \theta = 90^\circ$ $\theta = -30^\circ$ ✓ (1)	✓ $\theta = -30^\circ$ (1)
7.2	period / periode = $\frac{360^\circ}{2} = 180^\circ$ ✓ (1)	✓ 180° (1)
7.3	$-2 \leq y \leq 0$ ✓ of / or $[-2; 0]$ (1)	✓ $-2 \leq y \leq 0$ (1)
7.4	$45^\circ < x < 135^\circ$ ✓ or/or $150^\circ < x \leq 180^\circ$ ✓✓ (3)	✓ 45° and 135° ✓ 150° and 180° ✓ ALL inequalities correct <i>ALLE ongelykhede korrek</i> <i>Subtract 1 mark for extra intervals</i> <i>Trek 1 punt af vir ekstra intervale</i> (3)
7.5	$90^\circ < x < 150^\circ$ ✓ (2)	✓ 90° and/en 150° ✓ inequalities / ongelykhede (2)
		[8]

2008 June Higher Grade Paper 2 Q 4

QUESTION 4 [26]																	
4.1	$\frac{1}{2} \tan x = \sin 2x$ $\frac{\sin x}{2 \cos x} = 2 \sin x \cdot \cos x$ $\sin x - 4 \sin x \cdot \cos^2 x = 0$ $\sin x (1 - 4 \cos^2 x) = 0$ $\sin x = 0 \text{ or } \cos x = \pm \frac{1}{2}$ $x = -60^\circ; 0^\circ; 60^\circ; 120^\circ; 180^\circ$	2A reductions 1M simplification 1CA factorisation 1A $0^\circ; 180^\circ$ 2A $\pm 60^\circ; 120^\circ$															
4.2	 Each graph: <table> <tr> <td>Shape:</td><td>f ✓A</td><td>g ✓A</td></tr> <tr> <td>x-intercepts:</td><td>✓A</td><td>✓A</td></tr> <tr> <td>Range:</td><td>✓A</td><td>✓A</td></tr> <tr> <td>y-intercept</td><td>✓A</td><td>✓A</td></tr> <tr> <td>Asymptotes</td><td>✓A</td><td></td></tr> </table> (8)	Shape:	f ✓A	g ✓A	x-intercepts:	✓A	✓A	Range:	✓A	✓A	y-intercept	✓A	✓A	Asymptotes	✓A		
Shape:	f ✓A	g ✓A															
x-intercepts:	✓A	✓A															
Range:	✓A	✓A															
y-intercept	✓A	✓A															
Asymptotes	✓A																
4.3.1	$-60^\circ < x < 0^\circ$ ✓CA OR $x \in (-60^\circ; 0^\circ)$ $60^\circ < x < 90^\circ$ ✓CA OR $x \in (60^\circ; 90^\circ)$ $120^\circ < x < 180^\circ$ ✓CA ✓N OR $x \in (120^\circ; 180^\circ)$ (4)	3CA 1 for each interval 1N notation															
4.3.2	$x = 0^\circ$ or $x = 180^\circ$ (2)	1A solution 1A solution															
4.3.3	$-45^\circ < x < 0^\circ$ ✓CA OR $x \in (-45^\circ; 0^\circ)$ $0^\circ < x < 45^\circ$ ✓CA OR $x \in (0^\circ; 45^\circ)$ $135^\circ < x < 180^\circ$ ✓CA ✓N OR $x \in (135^\circ; 180^\circ)$ (4)	3CA each interval 1N notation															

QUESTION 4

[24]

4.1

$$\sin 2x = \cos (x - 30^\circ)$$

$$\sin 2x = \sin (90^\circ - (x - 30^\circ)) \quad \checkmark A$$

$$2x = 120^\circ - x + k \cdot 360^\circ \quad \checkmark A \quad \text{or} \quad 2x = 180^\circ - (120^\circ - x) \quad \checkmark A$$

$$3x = 120^\circ + k \cdot 360^\circ \quad \checkmark A \quad 2x = 60^\circ + x + k \cdot 360^\circ$$

$$x = 40^\circ + k \cdot 120^\circ; k \in \mathbb{Z} \quad x = 60^\circ + k \cdot 360^\circ$$

$$\checkmark CA \quad \checkmark CA \quad \checkmark CA$$

$$x = -80^\circ; 40^\circ; 160^\circ \quad x = 60^\circ \quad \checkmark CA$$

OR

$$\sin 2x = \cos (x - 30^\circ)$$

$$\cos (90^\circ - 2x) = \cos (x - 30^\circ) \quad \checkmark A$$

$$90^\circ - 2x = x - 30^\circ + k \cdot 360^\circ \quad \checkmark A \quad \text{or} \quad 90^\circ - 2x = -(x - 30^\circ) + k \cdot 360^\circ \quad \checkmark A$$

$$-3x = -120^\circ + k \cdot 360^\circ \quad -x = -60^\circ + k \cdot 360^\circ$$

$$x = 40^\circ + k \cdot 120^\circ; k \in \mathbb{Z} \quad x = 60^\circ + k \cdot 360^\circ$$

$$\checkmark CA \quad \checkmark CA \quad \checkmark CA$$

$$x = -80^\circ; 40^\circ; 160^\circ \quad x = 60^\circ \quad \checkmark CA$$

co-function

1 A solution 1st quad1 A solution 2nd quad.

4A – correct angles

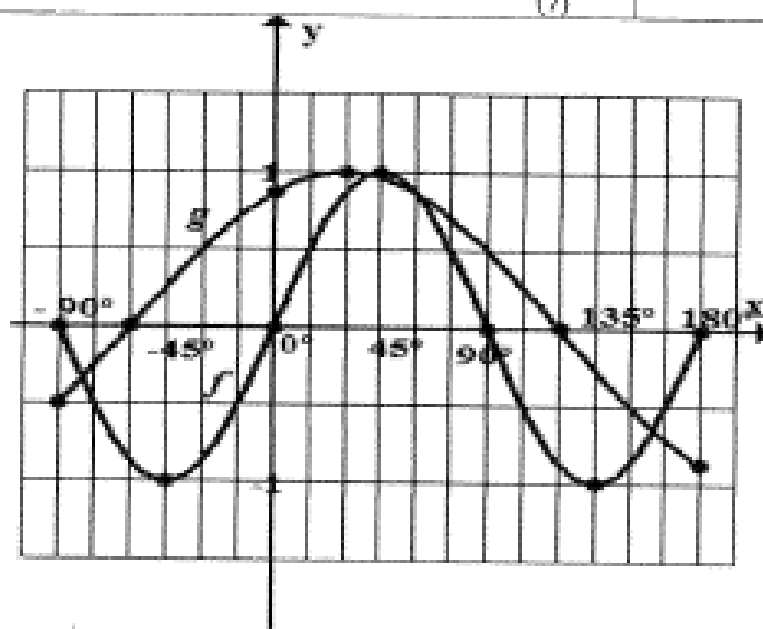
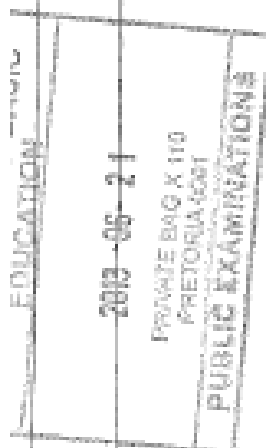
co-function

1 A solution 1st quad1 A solution 4th quad.

4A – correct angles

(7)

4.2



f

amplitude ✓ A

shape ✓ A

y-intercept ✓ A

x-intercepts ✓ A

g

Turning point (30°; 1) ✓ A

shape ✓ A

y-intercept ✓ A

x-intercepts ✓ A

All points to be visually read.

Shape includes end-points and turning points visually read.

(8)

4.3.1

$$x \in (-80^\circ; 40^\circ) \quad \text{or} \quad (60^\circ; 160^\circ)$$

$$-80^\circ < x < 40^\circ \quad \text{or} \quad 60^\circ < x < 160^\circ$$

(3)

each interval ✓ ✓ CA

✓ A notation

4.3.2

$$x \in [-90^\circ; 30^\circ)$$

$$-90^\circ \leq x < 30^\circ$$

(2)

interval ✓ CA

✓ A notation

4.3.3

$$x \in (-90^\circ; -60^\circ) \quad \text{or} \quad (0^\circ; 90^\circ) \quad \text{or} \quad (120^\circ; 180^\circ)$$

$$-90^\circ < x < -60^\circ \quad \text{or} \quad 0^\circ < x < 90^\circ \quad \text{or} \quad 120^\circ < x < 180^\circ$$

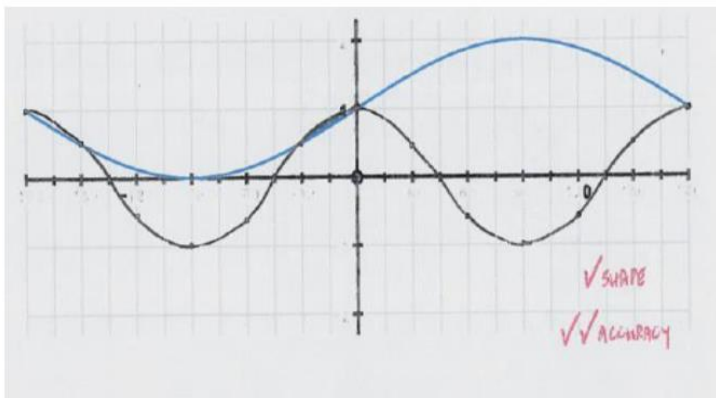
(4)

each interval ✓ ✓ ✓ CA

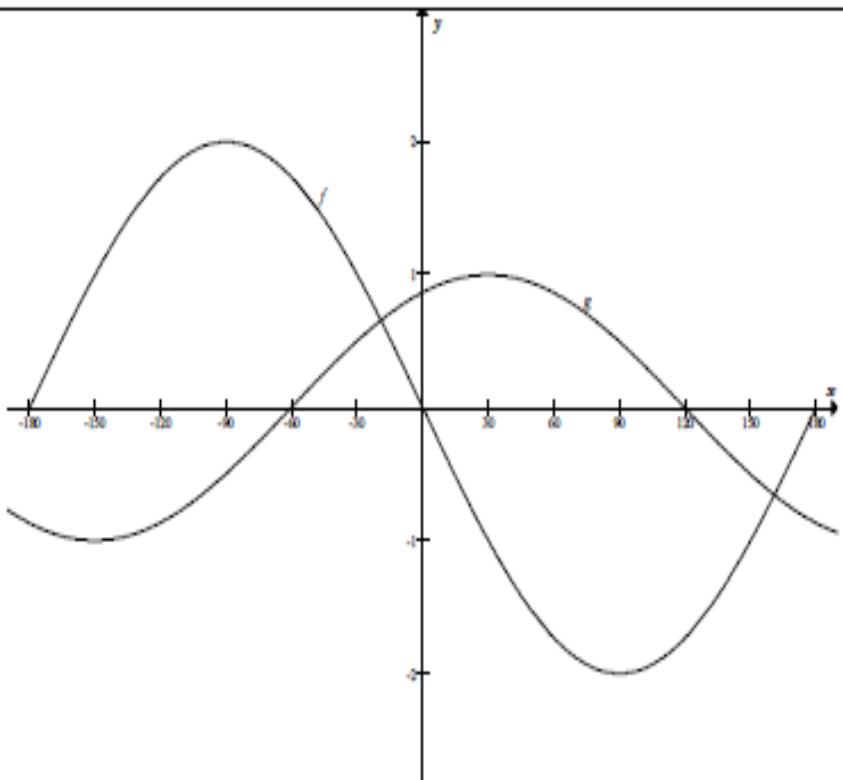
✓ A notation

2016 June Gauteng Paper 2 Q 6

QUESTION/VR4AG 6

6.1.1	$y = \tan 4x$	✓ $y = \tan 4x$ (1)
6.1.2	$y = 2 \cos 2x + 1$	✓ $y = 2 \cos 2x + 1$ (1)
6.1.3	$y = \sin(2x + 30^\circ)$ OR $y = \sin 2(x + 15^\circ)$	✓ sin ✓ $2x + 30^\circ$ or $2(x + 15^\circ)$ (2)
6.2.1		✓ shape ✓ four x-intercepts ✓ y-intercept (3)
6.2.2	$x \in [-135^\circ; -45^\circ]$ or $[45^\circ; 135^\circ]$ OR $-135^\circ \leq x \leq -45^\circ$ or $45^\circ \leq x \leq 135^\circ$	✓ $[-135^\circ; -45^\circ]$ ✓ $[45^\circ; 135^\circ]$ (2) [9]

QUESTION 12

12.1	Period = 360°	✓ answer (1)
12.2	Amplitude = $\frac{1}{2}$	✓✓ answer (2)
12.3		✓ shape ✓ x intercepts ✓ amplitude (3)
12.4	2 solutions	✓ answer (1)
12.5	$-60^\circ \leq x \leq 120^\circ$ or $x \in [-60^\circ; 120^\circ]$	✓ $-60^\circ; 120^\circ$ ✓ notation (2)
12.6	$-90^\circ < x < 30^\circ$ or $x \in (-90^\circ; 30^\circ)$	✓✓ $-90^\circ; 30^\circ$ ✓ notation (3)
		[12]

2011 June Higher Grade Paper 2 Q 4

4.1

	<i>f</i>	<i>g</i>
x-intercepts	✓	✓
y-intercepts	✓	✓
turning points		✓
period	✓	✓
asymptote	✓	
End Points	✓	✓

(10)

4.2.1	$x \in \{45^\circ; 225^\circ\}$ ✓CA ✓CA	(2)	values of x
4.2.2	$x = 45^\circ + k 180^\circ$ ✓CA ✓CA	$k \in \mathbb{Z}$ (3) ✓A	Interval Restriction on l
4.2.3 (a)	$x \in \{-45^\circ; 0^\circ; 135^\circ; 180^\circ\}$ ✓CA ✓CA ✓CA ✓CA	(4)	values of x
4.2.3 (b)	$x \in (90^\circ; 135^\circ)$ ✓CA ✓CA	✓A notation (3)	intervals notation

2012 Higher Grade P2 Q 4

QUESTION 4		[28]																		
4.1	$\frac{\tan x}{\sin x} = \frac{\sin 2x}{\cos x}$ $2 \sin x \cos^2 x - \sin x = 0$ $\sin x(2 \cos^2 x - 1) = 0$ $\sin x = 0 \quad \text{or} \quad \cos x = \pm \frac{1}{\sqrt{2}}$ Reference angle = 0° reference angle = 45° $x = \{-45^\circ; 0^\circ; 45^\circ; 135^\circ; 180^\circ\}$ Identity: $\tan x$ Identity: $\sin 2x$ quad eq Two equations – 1 for TWO Missing or incorrect $\angle$ s	(8)																		
4.2	<table border="1"> <thead> <tr> <th></th><th>f</th><th>G</th></tr> </thead> <tbody> <tr> <td>x-intercepts</td><td>✓</td><td>✓✓</td></tr> <tr> <td>y-intercept</td><td>✓</td><td>✓</td></tr> <tr> <td>turning points</td><td></td><td>✓</td></tr> <tr> <td>Positive shape</td><td>✓</td><td>✓</td></tr> <tr> <td>asymptotes</td><td>✓✓</td><td></td></tr> </tbody> </table> (10)		f	G	x-intercepts	✓	✓✓	y-intercept	✓	✓	turning points		✓	Positive shape	✓	✓	asymptotes	✓✓		DEPARTMENT OF BASIC EDUCATION 2012 -06- 01 PRIVATE BAG X 110 PRETORIA 0001 PUBLIC EXAMINATIONS
	f	G																		
x-intercepts	✓	✓✓																		
y-intercept	✓	✓																		
turning points		✓																		
Positive shape	✓	✓																		
asymptotes	✓✓																			
4.3.1	$x \in (-90^\circ; -45^\circ) \cup (0^\circ; 45^\circ) \cup (90^\circ; 135^\circ)$ (4)	each interval ✓✓✓CA ✓A notation																		
4.3.2	$x \in (-45^\circ; 45^\circ) \cup (135^\circ; 180^\circ)$ (3)	each interval ✓✓CA ✓A notation																		
4.3.3	$x = -45^\circ \text{ or } 45^\circ \text{ or } 135^\circ$ (3)	values of x ✓CA✓CA✓CA																		

2014 Higher Grade P2 Q 4

QUESTION 4		[20]
4.1.1	$a = -2 \checkmark A \checkmark A$ (2)	1A sign 1A value
4.1.2	$b = 45^\circ \checkmark A$ (1)	1A value
4.1.3	$c = 1 \checkmark A$ (1)	1A value
4.2	$y \in [-2 ; 2] \checkmark A$ OR $-2 \leq y \leq 2$ (1)	1A interval
4.3	$x_Q = 180^\circ - 28,68^\circ \checkmark A$ $= 151,32^\circ$ $\checkmark M$ $y_Q = -2 \sin 151,32^\circ = -0,96 \checkmark CA$ OR $\checkmark M$ $y_Q = \cos(151,32^\circ + 45^\circ) = -0,96 \checkmark CA$ $Q(151,32^\circ ; -0,96)$ (3)	1A obtuse angle 1M substit. for y_Q 1CA value for y_Q
4.4	$h(x) = \cos(x + 75^\circ) \checkmark CA \checkmark A$ (2)	1CA (see Q 4.1.2) 1A correct equation
4.5.1	$f(x) > g(x) \checkmark A$ $x \in (-28,68^\circ ; 151,32^\circ) \checkmark CA \checkmark CA \checkmark A$ OR $-28,68^\circ < x < 151,32^\circ$ $\checkmark CA$ (4)	1A simplification 2CA end points 1A correct notation
4.5.2	$\checkmark A$ $\checkmark CA$ $x \in [-135^\circ ; 0^\circ]$ or $x \in [45^\circ ; 180^\circ] \checkmark A$ OR $-135^\circ \leq x \leq 0^\circ$ or $45^\circ \leq x \leq 180^\circ$ (4)	1CA interval 1A correct notation 1CA interval 1A correct notation
4.5.3	$x \in (-90^\circ ; -45^\circ) \checkmark A \checkmark A$ OR $-90^\circ < x < -45^\circ$ (2)	1A end values 1A correct notation

2017 March P2 Q 5

5.1	$a = -1$ $b = 2$	✓ answer ✓ answer (2)
5.2	$f(3x) = -\sin 3x$ Period of $f(3x) = \frac{360^\circ}{3}$ $= 120^\circ$ Answer only: Full marks	✓ $\frac{360^\circ}{3}$ ✓ answer (2)
5.3	$x \in [90^\circ; 135^\circ) \cup \{180^\circ\}$ OR/OF $90^\circ \leq x < 135^\circ \text{ or } x = 180^\circ$	✓ 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)

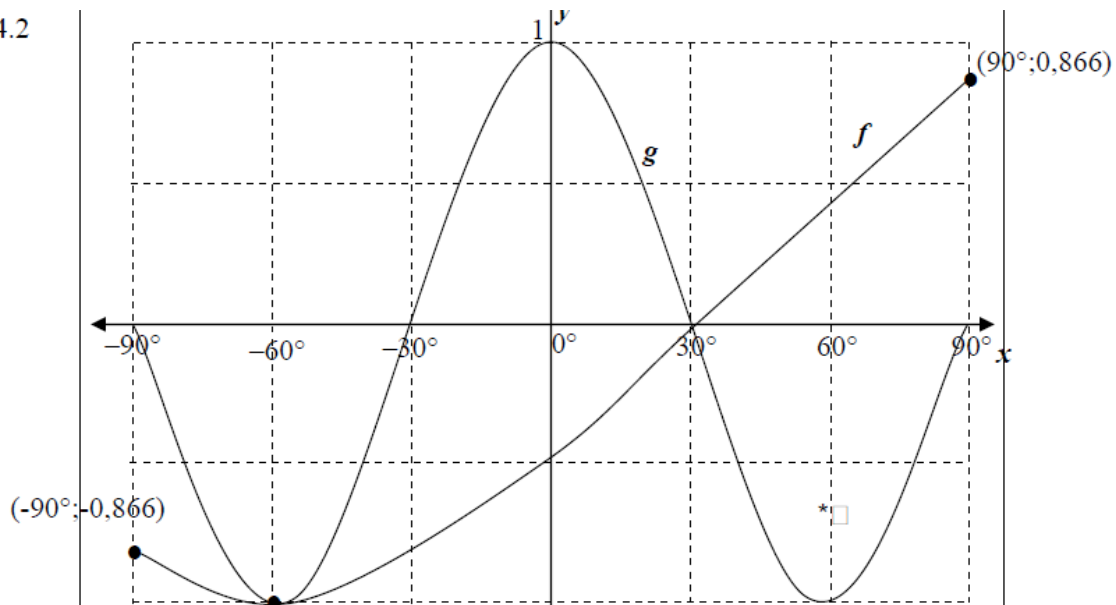
2010 Higher Grade P2 Q 4

4.1	$\sin(x + 45^\circ) = \cos 2x$ $\sin(x + 45^\circ) = \sin(90^\circ - 2x)$ ✓M ✓M $x + 45^\circ = 90^\circ - 2x + k \cdot 360^\circ$ OR $x + 45^\circ = 90^\circ + 2x + k \cdot 360^\circ$ ✓CA $x = 15^\circ + k \cdot 120^\circ$ OR ✓CA ✓A $x = -45^\circ - k \cdot 360^\circ$ ✓A ✓A ✓A ✓A $x \in \{-105^\circ; -45^\circ; 15^\circ; 135^\circ\}$	ko-funksie kwadrante oplossing na hoeke beperkings na k gebruik van $\pm 360^\circ$ (9) oplossings
4.2		

	<table border="1"> <thead> <tr> <th></th><th>f</th><th>g</th></tr> </thead> <tbody> <tr> <td>x-snitte</td><td>✓</td><td>✓</td></tr> <tr> <td>y-snitte</td><td>✓</td><td>✓</td></tr> <tr> <td>draaipunte</td><td>✓</td><td>✓</td></tr> <tr> <td>periode</td><td>✓</td><td>✓</td></tr> <tr> <td>eindpunten</td><td>✓</td><td></td></tr> </tbody> </table>		f	g	x-snitte	✓	✓	y-snitte	✓	✓	draaipunte	✓	✓	periode	✓	✓	eindpunten	✓		(9)
	f	g																		
x-snitte	✓	✓																		
y-snitte	✓	✓																		
draaipunte	✓	✓																		
periode	✓	✓																		
eindpunten	✓																			
4.3.1	$x \in (-90^\circ; 0^\circ)$ ✓CA ✓CA notasie ✓A	(3) interval notasie																		
4.3.2	$x \in (-105^\circ; -45^\circ) \cup (15^\circ; 135^\circ)$ ✓CA ✓CA ✓CA ✓CA	(4) intervale notasie																		

2009 Higher Grade P2 Q 4

4.2



	f	G
x intercepts	✓	✓
y intercepts	✓	✓
Turning points	✓✓	✓
End point values	✓✓	✓

(9)

4.3.1

$$x = 60^\circ \quad \checkmark \text{ A}$$

(1)

Value

4.3.2

$$x \in (30^\circ; 90^\circ] \quad \checkmark \text{ CA} \quad \checkmark \text{ CA} \quad \checkmark \text{ A}$$

(3)

1 each end p
1 notation

4.3.3

$$x \in (-90^\circ; -30^\circ) \quad \checkmark \text{ CA} \quad \checkmark \text{ CA} \quad \checkmark \text{ A}$$

(3)

1 each end p
1 notation

4.3.4

$$x \in (-60^\circ; -0^\circ) \quad \checkmark \text{ CA} \quad \checkmark \text{ CA} \quad \checkmark \text{ A}$$

(3)

1 each end p
1 notation

2016 Eastern Cape Prelim P2 Q 6

6.1

$$\sin(x + 60^\circ) = \sin(90^\circ - 2x)$$

$$\therefore x + 60^\circ = 90^\circ - 2x + 360^\circ k \text{ or/ of } x + 60^\circ = 180^\circ - (90^\circ - 2x) + 360^\circ k$$

$$3x = 30^\circ + 360^\circ k \quad \text{or/ of} \quad x = -30^\circ + 360^\circ k$$

$$x = 10^\circ + 120^\circ k$$

$$; k \in \mathbb{Z}$$

$$\therefore x = -30^\circ; 10^\circ; 130^\circ$$

OR/OF

$$\cos 2x = \cos(30^\circ - x)$$

$$2x = 30^\circ - x + 360^\circ k \quad \text{or} \quad 2x = -(30^\circ - x) + 360^\circ k; k \in \mathbb{Z}$$

$$3x = 30^\circ + 360^\circ k \quad \text{or} \quad x = -30^\circ + 360^\circ k$$

$$\therefore x = -30^\circ; 10^\circ; 130^\circ$$

✓ co-ratio / ko-funksie

✓ both gen. solns
beide algemene oplossings✓ -30° ✓ 10° ✓ 130°

✓ co-ratio / ko-funksie

✓ both gen. solns
beide algemene oplossings✓ -30° ✓ 10° ✓ 130°

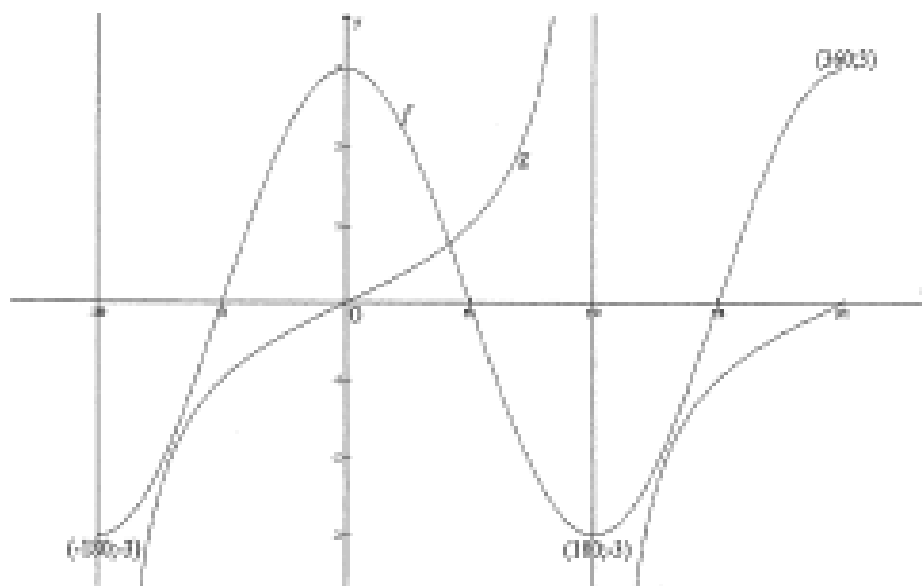
(5)

6.2		<i>g</i>: ✓ <i>x</i>-intercept. ✓ <i>x</i>-afsnit ✓ <i>y</i>-intercept. ✓ <i>y</i>-afsnit ✓ shape / vorm <i>f</i>: ✓ <i>x</i>-intercept. ✓ <i>x</i>-afsnit ✓ <i>y</i>-intercept. ✓ <i>y</i>-afsnit ✓ shape / vorm	(6)
6.3	240°	✓ answer / antwoord	(1)
6.4	$h(x) = \cos(2x - 90^\circ) - 1 = \sin 2x - 1$	✓ substitution / vervanging ✓ $\sin 2x - 1$	(2)

2016 Kwazulu Natal Prelim P2 Q 6

QUESTION 6

6.1



A✓ asymptotes
 A✓ shape of *f*
 A✓ shape of *g*
 A✓ correct *x*-intercept
 of *f* (-90° , 90° , 270°)
 A✓ correct *x*-intercept
 of *g* (0° , 360°)

(5)

6.2	360°	$A \neq 360^\circ$ (1)
6.3	$(0; 3)$ and $(180^\circ; -3)$ $(-180^\circ; -3)$ and $(360^\circ; 3)$	CA✓ for any two (2)
6.4	$-180^\circ < x < 0^\circ$ or $180^\circ < x < 360^\circ$ OR $-180^\circ < x < 0^\circ \cup 180^\circ < x < 360^\circ$	CA✓ $-180^\circ < x < 0^\circ$ CA✓ $180^\circ < x < 360^\circ$ [penalize one mark for incorrect notation] (2)
6.5	$y = 3\cos(x - 45^\circ)$	$A \neq 3\cos(x - 45^\circ)$ (1)

2008 November Paper 2 Q 8

8.1	$\cos 3x = \sin x$ $\sin(90^\circ - 3x) = \sin x$ $90^\circ - 3x = x + k.360^\circ$ $90^\circ - 3x = 180^\circ - x + k.360^\circ \quad k \in \mathbb{Z}$ $-4x = -90^\circ + k.360^\circ$ or $-2x = 90^\circ + k.360^\circ$ $x = 22,5^\circ - k.90^\circ \quad k \in \mathbb{Z}$ $x = -45^\circ - k.180^\circ \quad k \in \mathbb{Z}$ $x = -67,5^\circ; 22,5^\circ; 112,5^\circ$ $x = -45^\circ; 135^\circ$ OR $\cos 3x = \cos(90^\circ - x)$ $3x = 90^\circ - x + k.360^\circ$ $3x = 360^\circ - (90^\circ - x) + k.360^\circ$ $4x = 90^\circ + k.360^\circ$ or $2x = 270^\circ + k.360^\circ$ $x = 22,5^\circ + k.90^\circ \quad k \in \mathbb{Z}$ $x = 135^\circ + k.180^\circ \quad k \in \mathbb{Z}$ $x = -67,5^\circ; 22,5^\circ; 112,5^\circ$ $x = -45^\circ; 135^\circ$	✓ equating ✓ $90^\circ - 3x = x + k.360^\circ$ ✓ $x = 22,5^\circ - k.90^\circ$ ✓ ✓ $90^\circ - 3x = 180^\circ - x + k.360^\circ$ ✓ $x = -45^\circ - k.180^\circ$ ✓✓✓ values of x (8)
	OR $\cos 3x = \cos(90^\circ - x)$ $3x = 90^\circ - x + k.360^\circ$ $3x = -90^\circ + x + k.360^\circ$ $4x = 90^\circ + k.360^\circ$ or $2x = -90^\circ + k.360^\circ$ $x = 22,5^\circ + k.90^\circ \quad k \in \mathbb{Z}$ $x = -45^\circ - k.180^\circ \quad k \in \mathbb{Z}$ $x = -67,5^\circ; 22,5^\circ; 112,5^\circ$ $x = -45^\circ; 135^\circ$	✓ equating ✓ $3x = 90^\circ - x + k.360^\circ$ ✓ $x = 22,5^\circ + k.90^\circ$ ✓ ✓ $3x = 360^\circ - (90^\circ - x) + k.360^\circ$ ✓ $x = 135^\circ + k.180^\circ$ ✓✓✓ values of x (8)

Note:

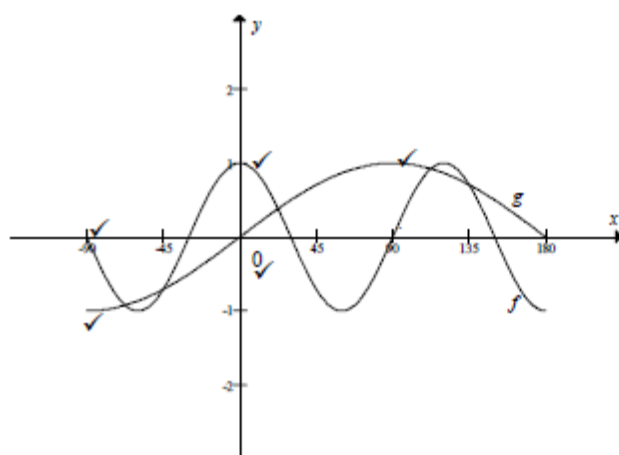
If not all 5 values for x is given, the following applies

4 or 3 values : 2 marks

2 values : 1 mark

1 value : 0 marks

8.2



(6)

Penalise with -1 going beyond the domain.

8.3

$$-67,5^\circ \leq x \leq -45^\circ$$

OR

$$x \in [-67,5^\circ; -45^\circ]$$

OR

From $-67,5^\circ$ up to and including -45°

✓✓ critical values

✓ notation

(3)

Note:

If $-67,5^\circ < x < -45^\circ$: 2/3

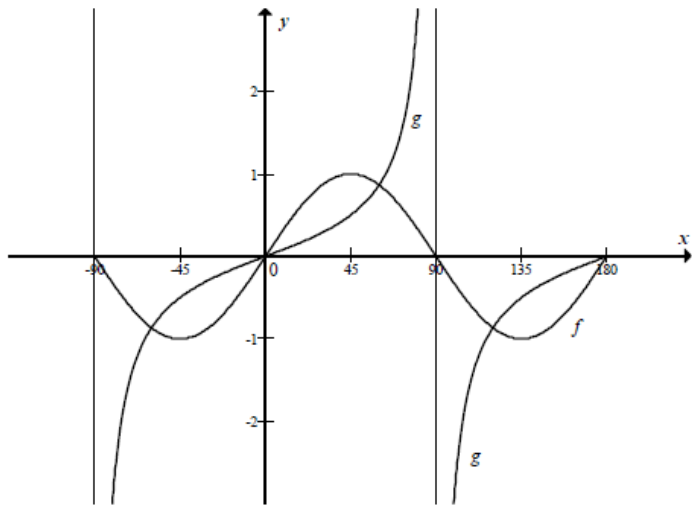
Half of the inequality: 1/3

If $x = -67,5^\circ$ or $x = -45^\circ$:
0/3

If answer is

$22,5^\circ \leq x \leq 112,5^\circ$ then 2 / 3

2009 March Paper 2 Q 8

8.1		tan graph ✓ shape ✓ asymptotes ✓ intercepts Sine graph ✓ shape ✓ intercepts ✓ period (6)
8.2	$\sin 2x = \frac{1}{2} \tan x$ $2 \sin x \cdot \cos x = \frac{\sin x}{2 \cos x}$ $4 \sin x \cdot \cos^2 x - \sin x = 0$ $\sin x (4 \cos^2 x - 1) = 0$ $\sin x = 0 \quad \cos^2 x = \frac{1}{4}$ $x = 0^\circ \text{ or } 180^\circ \text{ or } \cos x = \pm \frac{1}{2}$ $x = 60^\circ ; -60^\circ \text{ or } 120^\circ$	✓ equating ✓ $2 \cdot \sin x \cdot \cos x$ ✓ $\frac{\sin x}{2 \cos x}$ ✓ simplification ✓ factorisation ✓ $\sin x = 0$ ✓ $x = 0^\circ \text{ or } 180^\circ$ ✓ $\cos^2 x = \frac{1}{4}$ ✓ $\cos x = \pm \frac{1}{2}$ ✓ answers (10)
8.3	$\{x \mid -60^\circ < x < 0^\circ\} \cup \{x \mid 60^\circ < x < 90^\circ\} \cup \{x \mid 120^\circ < x < 180^\circ\}$ OR $x \in (-60^\circ ; 0^\circ) \cup (60^\circ ; 90^\circ) \cup (120^\circ ; 180^\circ)$ OR $-60^\circ < x < 0^\circ \text{ or } 60^\circ < x < 90^\circ \text{ or } 120^\circ < x < 180^\circ$	✓✓✓ answers (3) [19]

2009 November Paper 2 Q 12

12.1		✓ x-intercepts ✓ maximum/minimums (2)
12.2	$\cos(x - 30^\circ) = \frac{1}{2}$ $2 \cos(x - 30^\circ) = 1$ See points A and B on the graph	✓ manipulation ✓ answer (2)
12.3	$\cos(x - 30^\circ) = 0,5$ $x - 30^\circ = 60^\circ$ OR $x - 30^\circ = -60^\circ$ $x = 90^\circ$ OR $x = -30^\circ$	✓ 60° ✓ 90° ✓ -30° (3)
12.4	$g'(x) = 0$ is at maximum and minimum values of graph $x = 30^\circ; 210^\circ$	✓✓ answers (2)
12.5	$x \in [-90^\circ; -60^\circ) \cup (120^\circ; 270^\circ]$ OR $-90^\circ \leq x < -60^\circ$ or $120^\circ < x \leq 270^\circ$	✓ notation ✓✓ critical values (3) [12]

2010 March Paper 2 Q 11

11.1	$1 + \sin x = \cos 2x$ $1 + \sin x = 1 - 2 \sin^2 x$ $\sin x + 2 \sin^2 x = 0$ $\sin x(1 + 2 \sin x) = 0$ $\sin x = 0$ or $\sin x = -\frac{1}{2}$ $x = k \cdot 180$ or $x = -30^\circ + k \cdot 360$ or $x = 210^\circ + k \cdot 360$ $k \in \mathbb{Z}$ $x \in \{180^\circ; 210^\circ; 330^\circ; 360^\circ\}$ OR	✓ expansion ✓ factorisation ✓ equations ✓ $x = k \cdot 180$ ✓ solution for $\sin x = -\frac{1}{2}$ ✓✓ answers (7)
------	---	--

$1 + \sin x = \cos 2x$ $1 + \sin x = \cos^2 x - \sin^2 x$ $1 + \sin x = 1 - \sin^2 x - \sin^2 x$ $\sin x + 2\sin^2 x = 0$ $\sin x(1 + 2\sin x) = 0$ $\sin x = 0 \quad \text{or} \quad \sin x = -\frac{1}{2}$ $x = k.180 \quad \text{or} \quad x = -30^\circ + k.360 \quad k \in \mathbb{Z}$ $x = 210^\circ + k.360$ $x \in \{180^\circ; 210; 330^\circ; 360^\circ\}$	$\checkmark$ expansion $\checkmark$ factorisation $\checkmark$ equations $\checkmark x = k.180$ $\checkmark$ solution for $\sin x = -\frac{1}{2}$ $\checkmark\checkmark$ answers
--	--

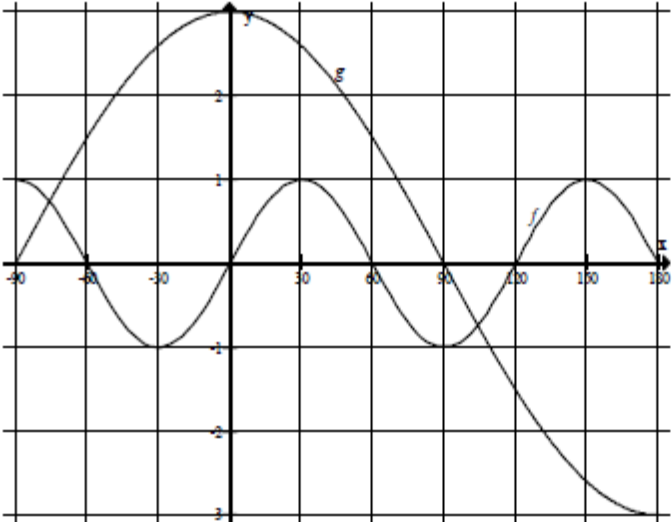
(7)

2011 November Paper 2 Q 10

10.1	$f(225^\circ) = 2$ $\therefore a \tan 225^\circ = 2 \quad \therefore a = 2$ $g(0) = 4$ $\therefore b \cos 0^\circ = 4 \quad \therefore b = 4$ Answer only: Full marks	$\checkmark$ substitution $\checkmark a = 2$ $\checkmark$ substitution $\checkmark b = 4$
10.2	Minimum value of $g(x) + 2 = -4 + 2 = -2$ Answer only: Full marks	$\checkmark -4$ $\checkmark -2$
10.3	Period = $\frac{180^\circ}{\frac{1}{2}} = 360^\circ$ Answer only: Full marks	$\checkmark \frac{180^\circ}{\frac{1}{2}}$ $\checkmark 360^\circ$
10.4	At P $f(\theta) = g(\theta)$ $2 \tan \theta = 4 \cos \theta$ for $180^\circ - \theta$: $2 \tan (180^\circ - \theta) = -2 \tan \theta$ and $4 \cos (180^\circ - \theta) = -4 \cos \theta$ $2 \tan \theta = 4 \cos \theta$ at P $\therefore -2 \tan \theta = -4 \cos \theta$ $\therefore 2 \tan (180^\circ - \theta) = 4 \cos (180^\circ - \theta)$ at Q OR	$\checkmark 2 \tan \theta = 4 \cos \theta$ $\checkmark 2 \tan (180^\circ - \theta) = -2 \tan \theta$ $\checkmark 4 \cos (180^\circ - \theta) = -4 \cos \theta$ $\checkmark 2 \tan (180^\circ - \theta) = 4 \cos (180^\circ - \theta)$
	$2 \tan \theta = 4 \cos \theta$ $\frac{\sin \theta}{\cos \theta} = 2 \cos \theta$ $\sin \theta = 2 \cos^2 \theta$ $= 2(1 - \sin^2 \theta)$	$\checkmark$ equation

$2\sin^2 \theta + \sin \theta - 2 = 0$ $\sin \theta = \frac{-1 \pm \sqrt{1 - 4(2)(-2)}}{4}$ $\sin \theta = 0,78077...$ $\theta = 51,33^\circ$ or $128,67^\circ$ $\therefore$ the x - coordinate of Q is $180^\circ - x_p$	$\checkmark \sin \theta = 0,78077...$ $\checkmark 51,33^\circ$ $\checkmark 128,67^\circ$ (4)
---	--

2012 March Paper 2 Q 10

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

2012 November Paper 2 Q 10

10.1	$f(0) - g(0) = 0,5 - (-2) = 2,5$	✓ 2,5 (1)
10.2	$\sin(x + 30^\circ) = -2 \cos x$ $\sin x \cdot \cos 30^\circ + \cos x \cdot \sin 30^\circ = -2 \cos x$ $\left(\frac{\sqrt{3}}{2}\right) \sin x + \left(\frac{1}{2}\right) \cos x = -2 \cos x$ $\sqrt{3} \sin x + \cos x = -4 \cos x$ $\sqrt{3} \sin x = -5 \cos x$ $\tan x = -\frac{5}{\sqrt{3}}$ $x = 109,11^\circ + 180^\circ k ; k \in \mathbb{Z}$ $x_P = -70,89^\circ$ and $x_Q = 109,11^\circ$ OR $\sin(x + 30^\circ) = -2 \cos x$ $\cos(90^\circ - x - 30^\circ) = -2 \cos x$ $\cos(60^\circ - x) = -2 \cos x$ $\cos 60^\circ \cos x + \sin 60^\circ \sin x = -2 \cos x$ $\frac{1}{2} \cos x + \frac{\sqrt{3}}{2} \sin x = -2 \cos x$ $\cos x + \sqrt{3} \sin x = -4 \cos x$ $\sqrt{3} \sin x = -5 \cos x$ $\tan x = -\frac{5}{\sqrt{3}}$ $x = 109,11^\circ + 180^\circ k ; k \in \mathbb{Z}$ $x_P = -70,89^\circ$ and $x_Q = 109,11^\circ$	✓ equation ✓ expansion of $\sin(x+30^\circ)$ ✓ substitution of special angles ✓ simplification ✓ $\tan x = -\frac{5}{\sqrt{3}}$ ✓ $x_P = -70,89^\circ$ ✓ $x_Q = 109,11^\circ$ (7) ✓ equation ✓ expansion of $\cos(60^\circ - x)$ ✓ substitution of special angles ✓ simplification ✓ $\tan x = -\frac{5}{\sqrt{3}}$ ✓ $x_P = -70,89^\circ$ ✓ $x_Q = 109,11^\circ$ (7)
10.3	$-70,89^\circ \leq x \leq 109,11^\circ$ OR $[-70,89^\circ ; 109,11^\circ]$ OR $x_P \leq x \leq x_Q$	✓ angles ✓ correct interval (2)
10.4	$h(x) = 2 \sin(x + 60^\circ + 30^\circ) = 2 \sin(x + 90^\circ) = 2 \cos x = -g(x)$ h is the reflection of g about the x -axis. OR f is shifted to the left through 60° and then doubled. $\therefore h$ is the reflection of g about the x -axis.	✓✓ reflection about the x -axis or line $y = 0$ (2) ✓✓ reflection about the x -axis or line $y = 0$ (2)

2013 March Paper 2 Q 10

10.1	Range = $[-1 ; 1]$	✓✓ $[-1 ; 1]$ (2)
10.2	$f\left(\frac{3}{2}x\right) = \sin 2\left(\frac{3}{2}x\right)$ $= \sin 3x$ $\therefore \text{Period} = \frac{360^\circ}{3} = 120^\circ$ OR $f\left(\frac{3}{2}x\right) = \sin 2\left(\frac{3}{2}x\right)$ $= \sin 3x$ $= \sin(3x + 360^\circ)$ $= \sin 3(x + 120^\circ)$ $\therefore \text{Period} = 120^\circ$	✓ $\sin 3x$ ✓ 120° ✓ $\sin 3x$ ✓ 120° (2)
10.3		✓ x intercepts ✓✓ turning points ✓ shape (4)
10.4	$(-180^\circ; -90^\circ) \text{ or } (-60^\circ; 0^\circ)$ OR $-180^\circ < x < -90^\circ \text{ or } -60^\circ < x < 0^\circ$	✓ $> -180^\circ$ ✓ $< -90^\circ$ ✓ $> -60^\circ$ ✓ $< 0^\circ$ (4)
10.5	$y = \sin 2(x + 30^\circ)$ $\therefore$ translation of 30° to the left	✓ translation 30° ✓ to the left (2)

10.6	$\sin 2x = \cos(x - 30^\circ)$ $\sin 2x = \sin[90^\circ - (x - 30^\circ)]$ $= \sin(120^\circ - x)$ $2x = 120^\circ - x + 360^\circ k; k \in \mathbb{Z}$ $3x = 120^\circ + 360^\circ k$ $x = 40^\circ + 120^\circ k; k \in \mathbb{Z}$	$2x = 180^\circ - (120^\circ - x) + 360^\circ k$ $x = 60^\circ + 360^\circ k; k \in \mathbb{Z}$	$\checkmark$ using co-function $\checkmark$ $2x = 120^\circ - x + 360^\circ k$ $\checkmark x = 40^\circ + 120^\circ k$ $\checkmark$ $2x = 180^\circ - (120^\circ - x)$ $+ 360^\circ k$ $\checkmark x = 60^\circ + 360^\circ k$ $\checkmark k \in \mathbb{Z}$ (6)
	OR $\sin 2x = \cos(x - 30^\circ)$ $\cos(90^\circ - 2x) = \cos(x - 30^\circ)$ $90^\circ - 2x = x - 30^\circ + 360^\circ k$ or $90^\circ - 2x = 360^\circ - (x - 30^\circ) + 360^\circ k$ $-3x = -120^\circ + 360^\circ k$ or $-x = 300^\circ + 360^\circ k$ $x = 40^\circ - 120^\circ k; k \in \mathbb{Z}$ or $x = -300^\circ - 360^\circ k; k \in \mathbb{Z}$ $\therefore x = 40^\circ + 120^\circ k$ or $x = 60^\circ + 360^\circ k; k \in \mathbb{Z}$		$\checkmark \cos(90^\circ - x) = \cos(x - 30^\circ)$ $\checkmark 90^\circ - 2x = x - 30^\circ$ $+ 360^\circ k$ $\checkmark x = 40^\circ - 120^\circ k$ $\checkmark$ $90^\circ - 2x = 360^\circ$ $-(x - 30^\circ) + 360^\circ k$ $\checkmark$ $x = -300^\circ - 360^\circ k$ $\checkmark k \in \mathbb{Z}$ (6)

2013 Gauteng June Paper 2 Q 10

10.1.1	120°		(1)
10.1.2	$-1 \leq y \leq 1$		(1)
10.1.3	$(30^\circ; 1)$		(1)
10.1.4	$h(x) = \sin x$		(1)

cosine graph: (4)

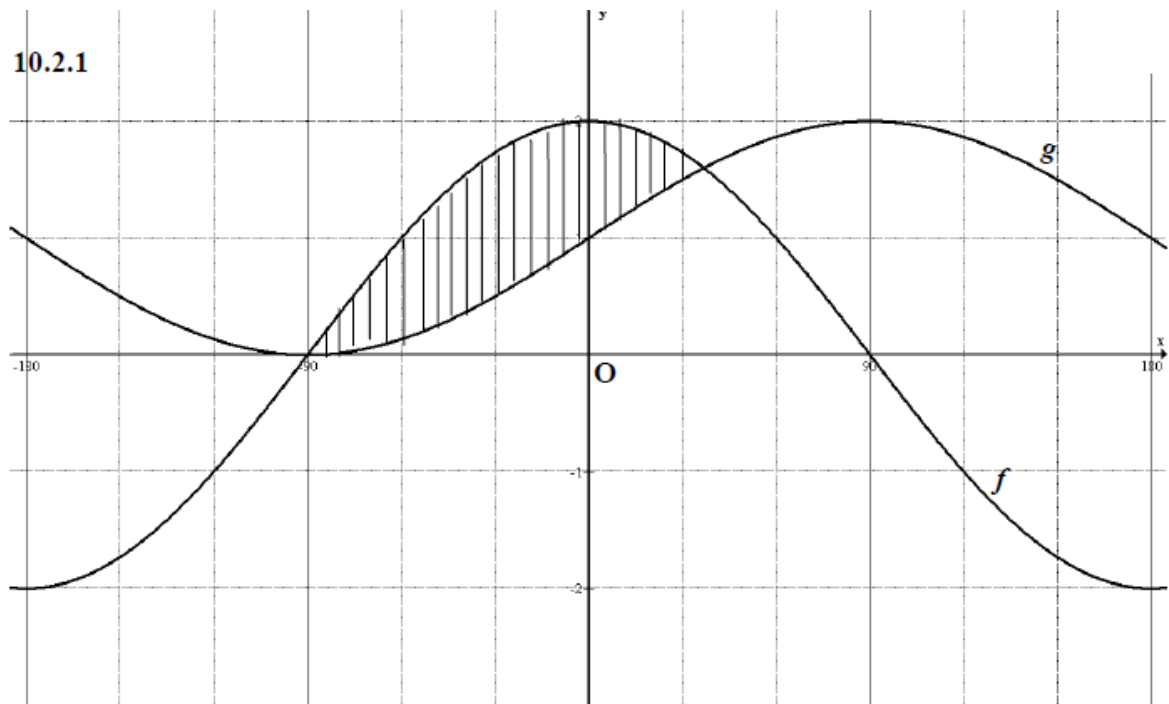
- $\checkmark$ turning points
- $\checkmark$ y-intercept
- $\checkmark$ endpoints
- $\checkmark$ x-intercepts

sine graph: (4)

- $\checkmark$ turning points
- $\checkmark$ x-intercept
- $\checkmark$ endpoints
- $\checkmark$ y-intercept

(8)

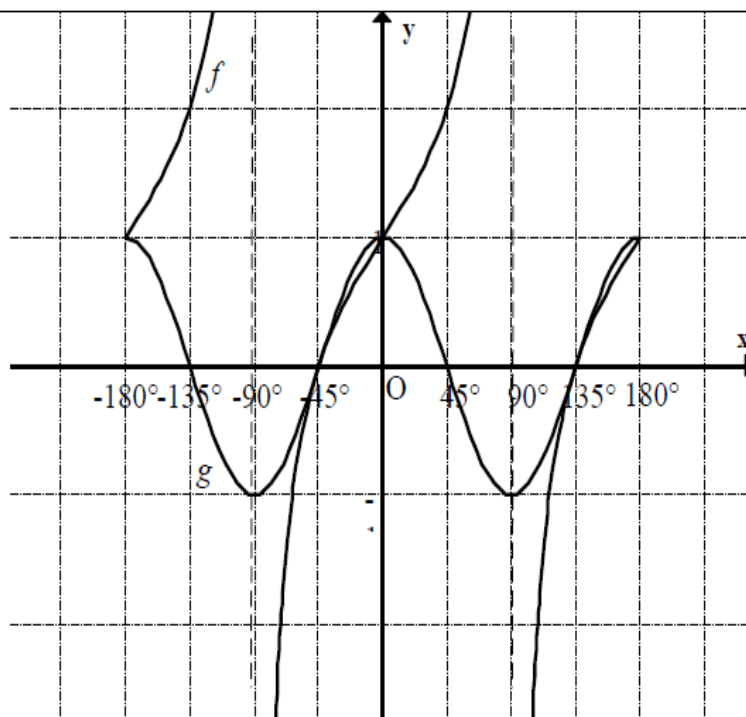
10.2.1



10.2.2	-90°	✓ answer	(1)
10.2.3(a)	See graph	✓ correct shading	(1)
(b)	$0^\circ < x < 180^\circ$	✓ endpoints ✓ notation	(2)

2013 November Paper 2 Q 12

12.1



- $y = \tan x + 1$
 ✓ asymptotes and shape for whole domain
 ✓ y intercept
 ✓ x intercepts

- $y = \cos 2x$
 ✓ x intercepts
 ✓ y intercept/TP
 ✓ minimum values

(6)

12.2	Period of g is 180° .	✓ 180° (1)
12.3	Reflected about the x-axis and then translated by 10° to the left/ <i>refleksie om die x-as en dan 'n translasië van 10° links.</i> OR Translated by 10° to the left and then reflected about the x-axis/ <i>Translasië van 10° links en dan 'n refleksie om die x-as.</i>	✓ reflected about x-axis/<i>refleksie om x-as</i> ✓ 10° to the left <i>10° na links</i> (2) ✓ 10° to the left <i>10° na links</i> ✓ reflected about x-axis/<i>refleksie om x-as</i> (2)
12.4	f is always increasing $\therefore f'(x) > 0$ always $\therefore g(x) > 0$ $\therefore 0^\circ < x < 45^\circ$ or $135^\circ < x \leq 180^\circ$ OR $\therefore x \in (0^\circ; 45^\circ)$ or $(135^\circ; 180^\circ]$	✓ critical values 0° and 45° ✓ inequality ✓ critical values 135° and 180° ✓ inequality (4)

2014 Exemplar Paper 2 Q 6

6.1	$b = \frac{1}{2}$	✓ value of b (1)
6.2	$A(30^\circ; 1)$	✓ 30° ✓ 1 (2)
6.3	$x = 160^\circ$	✓ $x = 160^\circ$ (1)
6.4	$h(x) = 2\cos(x - 30^\circ) + 1$ $y \in [-1; 3]$ OR $-1 \leq y \leq 3$	✓ critical values ✓ notation (2) [6]

2014 Eastern Cape Preliminary Paper 2 Q 8

8.1	2	✓ answer / antwoord	(1)
8.2		<i>f:</i> ✓ x-int/x-afsnit ✓ shape/vorm <i>g:</i> ✓ x-ints/x-afsnitte ✓ y-int/y-afsnit ✓ shape/vorm	(5)
8.3	$-120^\circ \leq x \leq 60^\circ$	✓ critical values / kritiese waardes ✓ notation/notasie	(2)
8.4	Translate f 30° to the right/Skuif f 30° na regs OR/OF Translate f down by $\frac{1}{2}$ / Skuif f $\frac{1}{2}$ eenheid af	✓ correct translation/korrekte translasië ✓ correct translation/korrekte translasië	(2)

2014 Gauteng Preliminary Paper 2 Q 7

7.1		<i>f:</i> ✓ shape ✓✓ intercepts ✓✓ turning points <i>g:</i> ✓ shape ✓✓ intercepts ✓✓ turning points	(6)
7.2	180°	✓ answer	(1)
7.3	$h(x) = -\frac{1}{2} \sin(x - 90^\circ)$ OR $h(x) = -\frac{1}{2} \sin[-(90^\circ - x)]$ $= -\frac{1}{2} [-\sin(90^\circ - x)]$ $\therefore h(x) = \frac{1}{2} \cos x$	✓✓ correct equation ✓ $-\frac{1}{2} \sin[-(90^\circ - x)]$ ✓ $\frac{1}{2} \cos x$	(2)

7.4	$\cos 2x = 1$ $2x = 0^\circ + k \cdot 360^\circ, k \in \mathbb{Z}$ $x = 0^\circ + k \cdot 180^\circ, k \in \mathbb{Z}$ OR $\cos 2x = 1$ $2x = k \cdot 360^\circ, k \in \mathbb{Z}$ $x = k \cdot 180^\circ, k \in \mathbb{Z}$	$\checkmark 2x = 0^\circ + k \cdot 360^\circ, k \in \mathbb{Z}$ $\checkmark x = 0^\circ + k \cdot 180^\circ$ $\checkmark 2x = k \cdot 360^\circ, k \in \mathbb{Z}$ $\checkmark x = k \cdot 180^\circ$
-----	---	--

(2)

(2)

2014 November Paper 2 Q 7

7.1	$0 \leq y \leq 2$ or $y \in [0; 2]$	$\checkmark$ critical values/ <i>kritieke waardes</i> $\checkmark$ notation/notasie
7.2	$\sin x + 1 = \cos 2x$ $\sin x + 1 = 1 - 2\sin^2 x$ $2\sin^2 x + \sin x = 0$ $\sin x(2\sin x + 1) = 0$	$\checkmark 1 - 2\sin^2 x$ $\checkmark$ st form/st vorm
7.3	$\sin x(2\sin x + 1) = 0$ $\sin x = 0$ or $\sin x = -\frac{1}{2}$ $x = 0^\circ + k \cdot 360^\circ$ or $x = 210^\circ + k \cdot 360^\circ$ or $x = 180^\circ + k \cdot 360^\circ$ or $x = 330^\circ + k \cdot 360^\circ, k \in \mathbb{Z}$ OR/OF $x = k \cdot 180^\circ, k \in \mathbb{Z}$	$\checkmark \sin x = 0$ or $\sin x = -\frac{1}{2}$ $\checkmark 0^\circ; 180^\circ$ OR/OF $x = k \cdot 180^\circ$ $\checkmark 210^\circ; 330^\circ$ $\checkmark k \cdot 360^\circ, k \in \mathbb{Z}$
7.4		$\checkmark$ y-intercept/afsnit $\checkmark$ x-intercepts/afsnitte $\checkmark$ min/max points/ <i>min/maks punte</i>

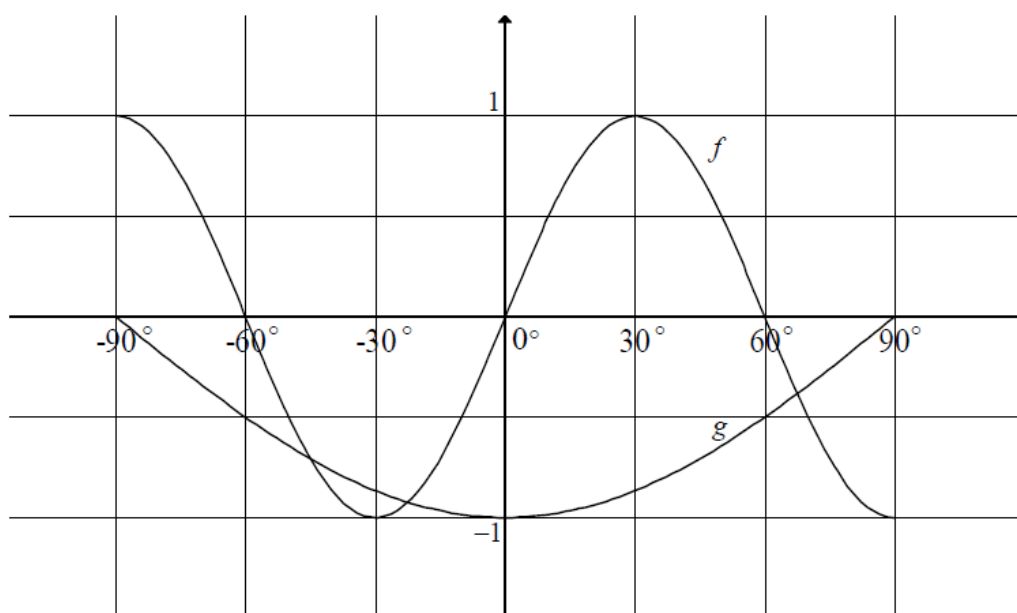
(3)

7.5	$f(x) = g(x)$ at/by: $x = -30^\circ; 0^\circ; 180^\circ; 210^\circ$ $\therefore f(x + 30^\circ) = g(x + 30^\circ)$ at/by: $x = -60^\circ; -30^\circ; 150^\circ; 180^\circ$	$\checkmark -30^\circ; 0^\circ; 180^\circ; 210^\circ$ $\checkmark -60^\circ; -30^\circ;$ $150^\circ; 180^\circ$
-----	---	---

(3)

7.6	Series will converge if/Reeks sal konvergeer as: $-1 < r < 1$ $-1 < 2\cos 2x < 1$ $-\frac{1}{2} < \cos 2x < \frac{1}{2}$ $\therefore 30^\circ < x < 60^\circ$ or $x \in (30^\circ ; 60^\circ)$	✓ $-1 < r < 1$ ✓ $r = 2\cos 2x$ ✓ $-\frac{1}{2} < \cos 2x < \frac{1}{2}$ ✓✓ $30^\circ < x < 60^\circ$ (5)
-----	---	--

2015 Senior Certificate Paper 2 Q 6



6.1	Period of/Periode van $f = 120^\circ$	✓ 120° (1)
6.2	$b = 3$	✓ $b = 3$ (1)
6.3	$x = -45^\circ$ or/of $x = -22,5^\circ$ or/of $x = 67,5^\circ$	✓ $x = -45^\circ$ ✓ $x = -22,5^\circ$ ✓ $x = 67,5^\circ$ (3)
6.4	$x \in (-45^\circ ; -22,5^\circ) \cup (67,5^\circ ; 90^\circ]$ OR/OF $-45^\circ < x < -22,5^\circ$ or/of $67,5^\circ < x \leq 90^\circ$	✓ critical values ✓ notation ✓ critical values ✓ notation (4) ✓ kritieke waardes ✓ notasie ✓ kritieke waardes ✓ notasie (4)

2015 Western Cape June Paper 2 Q 7

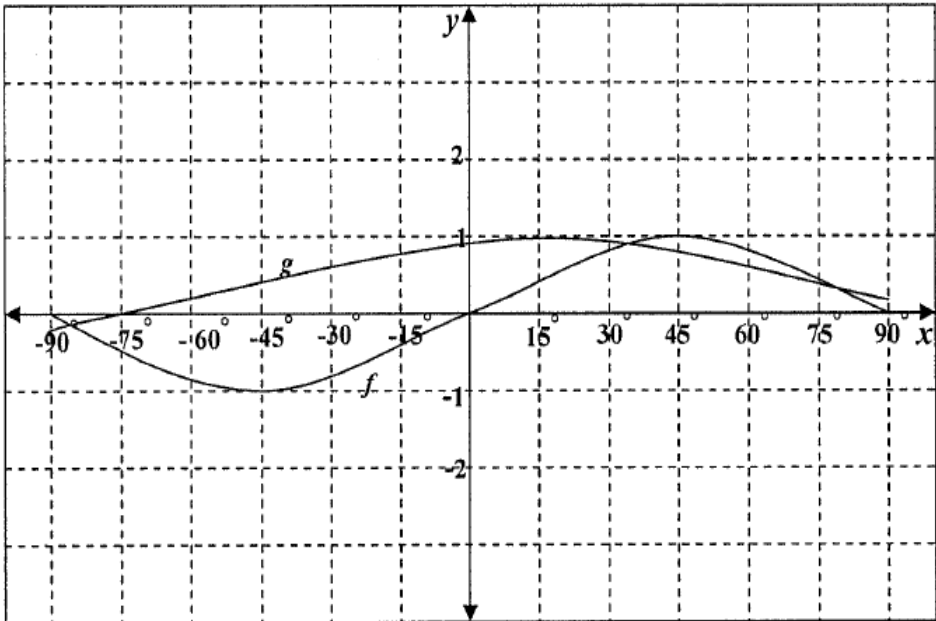
7.1	180°	✓ Answer/ Antw.	(1)
7.2	$\cos 2x = -\sin x$ $\therefore 1 - 2\sin^2 x = -\sin x$ $\therefore 2\sin^2 x - \sin x - 1 = 0$ $\therefore (2\sin x + 1)(\sin x - 1) = 0$ $\therefore \sin x = -\frac{1}{2} \text{ or } \sin x = 1$ $\therefore x = -30^\circ \text{ or } 90^\circ$	✓ $1 - 2\sin^2 x$ ✓ st-form/std vorm ✓ $\sin x = -\frac{1}{2} \text{ or } \sin x = 1$ ✓ $x = -30^\circ \text{ or } 90^\circ$	(4)
7.3		✓ y- intercepts/ afsnitte ✓ x- intercepts/ afsnitte ✓ min/max points Min/maks punte	(3)
7.4.1	$-90^\circ \leq x < -45^\circ$ $0^\circ < x < 45^\circ$ OR/ OF $x \in [-90^\circ; -45^\circ) \cup (0; 45^\circ)$	✓✓ Each/ elke interval	(2)
7.4.2	$x = -90^\circ$	✓ Answer/ Antw	(1)

2015 Gauteng Preliminary Paper 2 Q 7

7.1.1		✓ both intercepts ✓ shape ✓ both asymptotes	(3)
-------	--	---	-----

7.1.2	$\sin x \cos 45^\circ + \sin 45^\circ \cos x = \cos (x + 45^\circ)$ $\sin (x + 45^\circ) = \cos (x + 45^\circ)$ $\frac{\sin (x + 45^\circ)}{\cos (x + 45^\circ)} = 1$ $\tan (x + 45^\circ) = 1$ From the graph $x = 0^\circ$	$\checkmark \sin 45^\circ$ $\checkmark \sin (x + 45^\circ)$ $\checkmark \tan (x + 45^\circ) = 1$ $\checkmark x = 0^\circ$
		(4)
7.2.1	$a = 2$ $b = \frac{-1}{2}$	$\checkmark a = 2$ $\checkmark b = \frac{-1}{2}$
		(2)
7.2.2	360°	$\checkmark$ answer
		(1)
7.2.3	-1	$\checkmark$ answer
		(1)
7.2.4	$45^\circ < x < 135^\circ$ OR $x \in (45^\circ; 135^\circ)$	$\checkmark$ both values $\checkmark$ both inequalities OR $\checkmark$ interval notation $\checkmark$ both values
		(2)

2015 Free State Preliminary Paper 2 Q 8

8.1	Period of $f = 180^\circ$	$\checkmark 180^\circ$
		(1)
8.2		

	$g(x) :$ ✓ x -intercepts ✓ y -intercepts ✓ Turning points ✓✓ End points	(5)
8.3	$\sin 2x = \cos(x-15^\circ)$ $\cos(90^\circ - 2x) = \cos(x-15^\circ)$ $90^\circ - 2x = \pm(x-15^\circ) + k360^\circ$ $90^\circ - 2x = x - 15^\circ + k360^\circ$ or $90^\circ - 2x = -(x-15^\circ) + k360^\circ$ $-3x = -105^\circ + k360^\circ$ or $-x = -75^\circ + k360^\circ (k \in \mathbb{Z})$ $x = 35^\circ + k120^\circ$ or $x = 75^\circ + k360^\circ$ $x = -85^\circ; 35^\circ; 75^\circ$	✓ $\cos(90 - 2x)$ ✓ $90^\circ - 2x = \pm(x-15^\circ) + k360^\circ$ ✓ $x = 35^\circ + k120^\circ$ ✓ $x = 75^\circ + k360^\circ$ ✓ $x = -85^\circ$ ✓ $x = 35^\circ$ ✓ $x = 75^\circ$
8.4	$-85^\circ < x < 35^\circ$ or $x > 75^\circ$	✓✓ Critical values ✓ and notation (3)

2015 Eastern Cape Preliminary Paper 2 Q 6

6.1	120°	✓ answer.	(1)
6.2		f ✓ x -int ✓ y -int ✓ turning point g ✓ x -int ✓ y -int ✓ turning point	(6)
6.3	6.3.1	$x \in (30^\circ; 90]$	✓ both values correct ✓ correct notation
			(2)

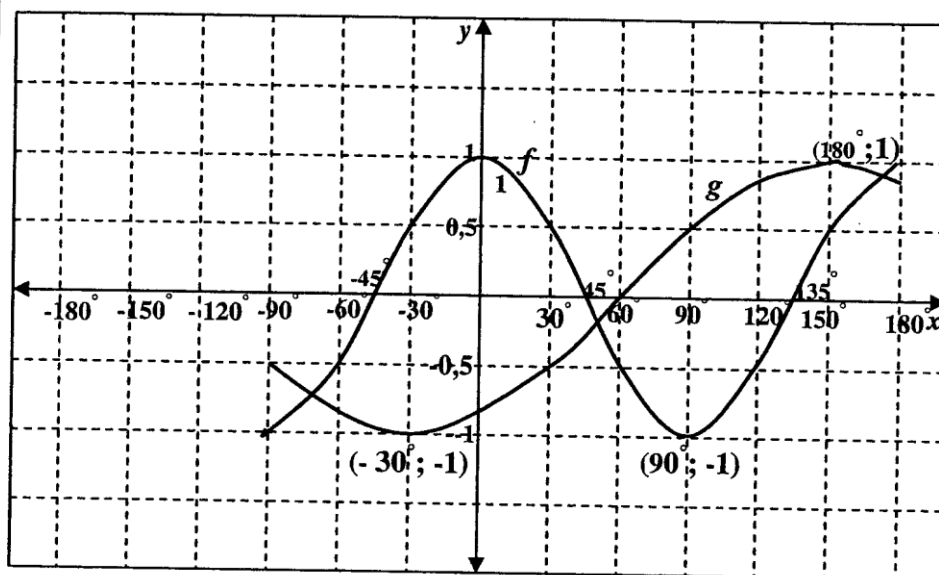
6.3.2	$x \in (-90^\circ; -30^\circ)$	✓ both values correct ✓ correct notation	(2)
6.4	$-4 \leq y \leq 0,5$ OR $[-4; 0,5]$	✓ interval ✓ values	(2)

2015 Kwazulu Natal Preliminary Paper 2 Q 6

6.1	$\cos 2x = \sin(x - 30^\circ)$ $= \cos[90^\circ - (x - 30^\circ)]$ $= \cos(120^\circ - x)$ key angle $= 120^\circ - x$ $2x = 120^\circ - x + n.360^\circ; n \in \mathbb{Z}$ $3x = 120^\circ + n.360^\circ; n \in \mathbb{Z}$ $x = 40^\circ + n.120^\circ; n \in \mathbb{Z}$ or $2x = 360^\circ - (120^\circ - x) + n.360^\circ; n \in \mathbb{Z}$ $2x = 240^\circ + x + n.360^\circ; n \in \mathbb{Z}$ $x = 240^\circ + n.360^\circ; n \in \mathbb{Z}$	✓ using co-ratio ✓ $120^\circ - x$ ✓ $2x = 120^\circ - x + n.360^\circ$ ✓ $x = 40^\circ + n.120^\circ$ ✓ $-2x = 360^\circ - (120^\circ - x) + n.360^\circ$ ✓ $x = 240^\circ + n.360^\circ$ ✓ $n \in \mathbb{Z}$	(7)
6.2		f ✓ x-intercepts ✓ turning points ✓ shape g ✓ intercepts ✓ turning points ✓ shape	(6)
6.3	$-120^\circ < x < -80^\circ$ or $40^\circ < x \leq 90^\circ$	✓ critical values: $-120^\circ; -80^\circ$ ✓ critical values: $40^\circ; 90^\circ$ ✓ correct notation	(3)

2015 North West Preliminary Paper 2 Q 6

6.1



- f: ✓ x-intercept
 ✓ y-intercept
 ✓ shape/TP
 g: ✓ x-intercept
 ✓ y-intercept
 ✓ TP

(6)

6.2

$(60^\circ ; 180^\circ]$ or $60^\circ < x \leq 180^\circ$

- ✓✓ end values
 ✓ notation

(3)

2015 Western Cape Preliminary Paper 2 Q 6

6.1

$$\begin{aligned} \sin(x + 30^\circ) &= \cos 3x \\ &= \sin(90^\circ - 3x) \\ x + 30^\circ &= 90^\circ - 3x + k \cdot 360^\circ \\ 4x &= 60^\circ + k \cdot 360^\circ \\ x &= 15^\circ + k \cdot 90^\circ \\ \text{or} \\ x + 30^\circ &= 180^\circ - (90^\circ - 3x) + k \cdot 360^\circ \\ -2x &= 60^\circ + k \cdot 360^\circ \\ x &= -30^\circ - k \cdot 180^\circ ; k \in \mathbb{Z} \\ \text{OR} \\ \sin(x + 30^\circ) &= \cos 3x \\ \cos[90^\circ - (x + 30^\circ)] &= \cos 3x \\ 90^\circ - (x + 30^\circ) &= 3x + k \cdot 360^\circ \\ -4x &= -60^\circ + k \cdot 360^\circ \\ x &= 15^\circ - k \cdot 90^\circ \\ \text{or} \\ 90^\circ - (x + 30^\circ) &= 360^\circ - 3x + k \cdot 360^\circ \\ 2x &= 300^\circ + k \cdot 360^\circ \\ x &= 150^\circ + k \cdot 180^\circ ; k \in \mathbb{Z} \end{aligned}$$

- ✓ co-ratio
 ✓ equation
 ✓ general solution
 ✓ equation
 ✓ general solution ✓ $k \in \mathbb{Z}$
 ✓ co-ratio
 ✓ equation
 ✓ general solution
 ✓ equation
 ✓ general solution ✓ $k \in \mathbb{Z}$

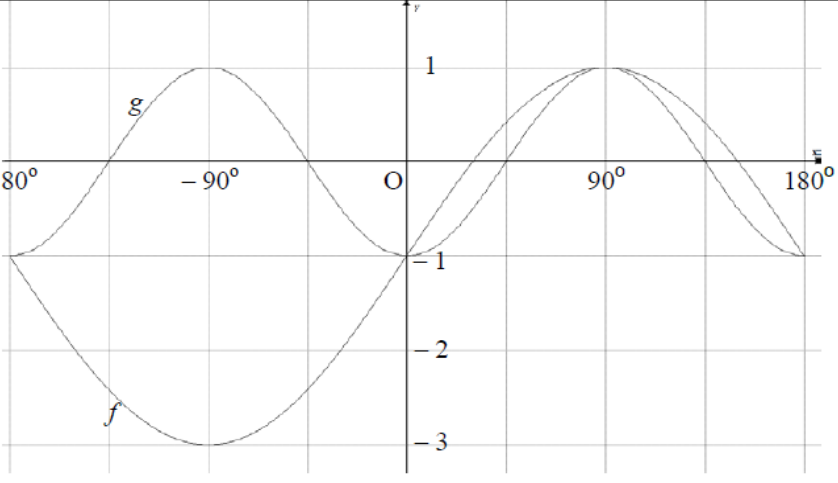
(6)

2016 March Paper 2 Q 6

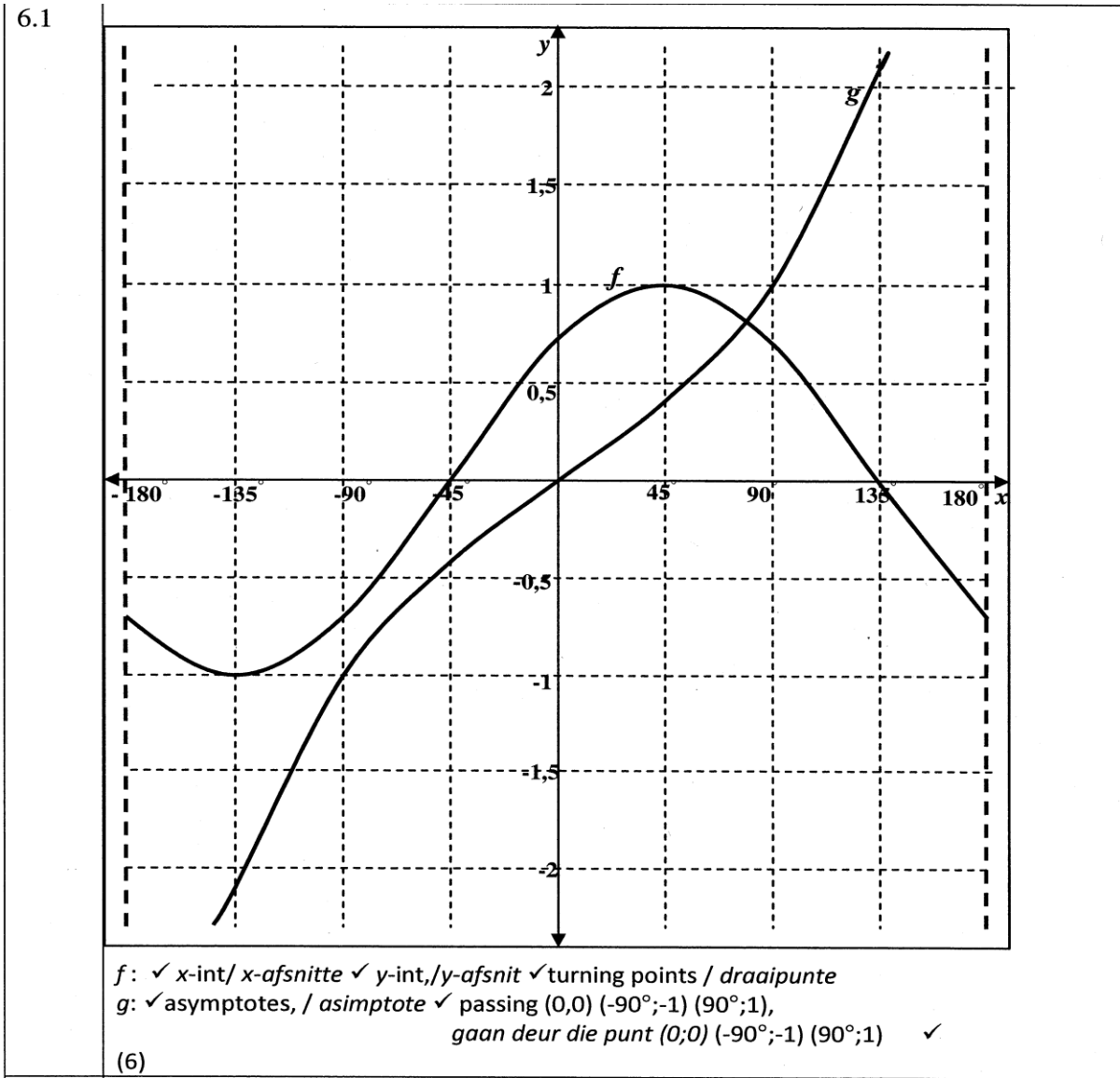
6.1	$\sin(x + 60^\circ) + 2\cos x = 0$ $\sin x \cos 60^\circ + \cos x \sin 60^\circ + 2\cos x = 0$ $\frac{1}{2}\sin x + \frac{\sqrt{3}}{2}\cos x + 2\cos x = 0$ $\frac{1}{2}\sin x = -2\cos x - \frac{\sqrt{3}}{2}\cos x$ $\sin x = -4\cos x - \sqrt{3}\cos x$ $\sin x = \cos x(-4 - \sqrt{3})$ $\frac{\sin x}{\cos x} = \frac{\cos x(-4 - \sqrt{3})}{\cos x}$ $\therefore \tan x = -4 - \sqrt{3}$	✓ expansion/uitbreiding ✓ special angle values/ <i>spesiale ∠-waardes</i> ✓ simpl/vereen ✓ $\sin x = \cos x(-4 - \sqrt{3})$ (4)
6.2	$\tan x = -4 - \sqrt{3}$ $\tan x = -(4 + \sqrt{3})$ $\text{ref } \angle = 80,10^\circ$ $x = -80,1^\circ \text{ or/of } 99,9^\circ$	✓ 80,10° ✓ 99,90° ✓ -80,1° (3)
6.3.1		✓ (30° ; 1) ✓ (-60° ; 0) ✓ shape/vorm (3)
6.3.2	$\therefore \sin(x + 60^\circ) > -2\cos x$ $x \in (-80,10^\circ ; 99,90^\circ) \text{ OR/OF } -80,10^\circ < x < 99,90^\circ$	✓✓ critical values/ <i>kritiese waardes</i> ✓ notation/notasie (3)

2016 Senior Certificate Paper 2 Q 6

6.1	$4\sin x + 2\cos 2x = 2$ $2\sin x + \cos 2x - 1 = 0$ $2\sin x + (1 - 2\sin^2 x) - 1 = 0$ $2\sin^2 x - 2\sin x = 0$ $2\sin x(\sin x - 1) = 0$ $2\sin x = 0 \quad \text{or} \quad \sin x - 1 = 0$ $\sin x = 0 \quad \sin x = 1$ $x = k.180^\circ \text{ or } x = 90^\circ + k.360, k \in \mathbb{Z}$	✓ using identity ✓ standard form ✓ factors ✓ $\sin x = 0$ or $\sin x = 1$ ✓ $k.180^\circ$ ✓ $90^\circ + k.360, k \in \mathbb{Z}$ (6)
-----	---	--

6.2.1		✓ turning point $(-90^\circ; -3)$ ✓ turning point $(90^\circ; 1)$ ✓ $(-180^\circ; -1)$ & $(0^\circ; -1)$
6.2.2	$(-90^\circ; 0^\circ)$ OR/OF $-90^\circ < x < 0^\circ$	✓ ✓ answer (3) (2) ✓ ✓ answer (2)
6.2.3	$f(x) = g(x)$ $\therefore -180^\circ; 0^\circ; 90^\circ; 180^\circ$ $f(x + 30^\circ) = g(x + 30^\circ)$ $\therefore x = -30^\circ; 60^\circ; 150^\circ$	✓ any ONE correct ✓ other 2 correct (2)

2016 North West Preliminary Paper 2 Q 6



6.2.1	$x = -45^\circ$ or $x = 135^\circ$	✓ $x = -45^\circ$ ✓ $x = 135^\circ$ (2)
6.2.2	$x = 180^\circ$ or / of $x = -180^\circ$	✓ $x = 180^\circ$ ✓ $x = -180^\circ$ (2)
6.2.3	$y \in [-1;1]$ or / of $-1 \leq y \leq 1$	✓ answer / antw (1)
6.2.4	1	✓ answer / antw (1)
6.2.5	$x \in (-180^\circ; -45^\circ)$ or / of $(0^\circ; 135^\circ)$ OR $-180^\circ < x < -45^\circ$ or / of $0^\circ < x < 135^\circ$	✓ $-180^\circ; -45^\circ$ ✓ $0^\circ; 135^\circ$ ✓ notation / notasie (3)

2016 Overberg District Preliminary Paper 2 Q 6

6.1	120°	✓ Answer/ Antw	(1)
6.2	1	✓ Answer/ Antw	(1)
6.3	$-2 \leq y \leq 0$ Or/ Of $y \in [-2; 0]$	✓ Answer/Antw	(1)
6.4	$\cos(x - 60^\circ) = \sin 3x$ $= \cos(90^\circ - 3x^\circ)$ $x - 60^\circ = 90^\circ - 3x + n.360^\circ$ or $x - 60^\circ = 360^\circ - (90^\circ - 3x) + n.360^\circ$ $4x = 150 + n.360^\circ$ or $-2x = 330^\circ + n.360^\circ$ $x = 37,5^\circ + n.90^\circ$ or $x = -165^\circ - n.180^\circ, n \in \mathbb{Z}$ $\therefore x = 37,5^\circ; 15^\circ; -52,5^\circ$ OR/OR $\cos(x - 60^\circ) = \sin 3x$ $= \cos(90^\circ - 3x^\circ)$ $90^\circ - 3x = x - 60^\circ + n.360^\circ$ or $90^\circ - 3x = 360^\circ - (x - 60^\circ) + n.360^\circ$ $-4x = -150 + n.360^\circ$ or $2x = 330^\circ + n.360^\circ$ $x = 37,5^\circ - n.90^\circ$ or $x = 165^\circ + n.180^\circ, n \in \mathbb{Z}$ $\therefore x = 37,5^\circ; 15^\circ; -52,5^\circ$ OR/OF $\cos(x - 60^\circ) = \sin 3x$ $\therefore \sin[90^\circ - (x - 60^\circ)] = \sin 3x$	✓ Equating/ Vergelyking ✓ $\sin 3x = \cos(90^\circ - 3x^\circ)$ ✓ both equations/ beide vergelykings: $x - 60^\circ = 90^\circ - 3x + n.360^\circ$ or/ of $x - 60^\circ = 360^\circ - (90^\circ - 3x) + n.360^\circ$ ✓✓ both general solutions/ beide algemene oplossings ✓ $37,5^\circ$ & 15° & $-52,5^\circ$ (-1 per mistake) OR/OF ✓ Equating/ Vergelyking ✓ $\sin 3x = \cos(90^\circ - 3x)$ ✓ both equations/ beide vergelykings: $90^\circ - 3x = x - 60^\circ + n.360^\circ$ or $90^\circ - 3x = 360^\circ - (x - 60^\circ) + n.360^\circ$ ✓✓ both general solutions/ beide algemene oplossings ✓ $37,5^\circ$ & 15° & $-52,5^\circ$ (-1 per mistake) OR/OF ✓ Equating/ Vergelyking	(6)

$\therefore \sin(150^\circ - x) = \sin 3x$ $150^\circ - x = 3x + n.360^\circ$ or $(150^\circ - x) = 180^\circ - 3x + n.360^\circ$ $-4x = -150^\circ + n.360^\circ$ or $2x = 30^\circ + n.360^\circ$ $x = 37,5^\circ - n.90^\circ$ or $x = 15^\circ + n.180^\circ, n \in \mathbb{Z}$ $\therefore x = 37,5^\circ; 15^\circ; -52,5^\circ$	✓ $\cos(x - 60^\circ) = \sin(150^\circ - x)$ ✓ both equations/ beide vergelykings: $150^\circ - x = 3x + n.360^\circ$ or $(150^\circ - x) = 180^\circ - 3x + n.360^\circ$ ✓✓ both general solutions/ beide algemene oplossings
---	--

	OR/ OF $\sin[90^\circ - (x - 60^\circ)] = \sin 3x$ $\therefore \sin 3x = \sin(150^\circ - x)$ $3x = 150^\circ - x + n \cdot 360^\circ \quad \text{or} \quad 3x = 180^\circ - (150^\circ - x) + n \cdot 360^\circ$ $4x = 150^\circ + n \cdot 360^\circ$ $2x = 30^\circ + n \cdot 360^\circ$ $x = 37,5^\circ + n \cdot 90^\circ \quad \text{or}$ $x = 15^\circ + n \cdot 180^\circ, \quad n \in \mathbb{Z}$ $\therefore x = 37,5^\circ; 15^\circ; -52,5^\circ$	✓ 37,5° & 15° & -52,5° (-1 per mistake) OR/OF ✓ Equating/ <i>Vergelyking</i> ✓ $\cos(x - 60^\circ) = \sin(150^\circ - x)$ ✓ both equations/ <i>beide vergelykings</i>: $3x = 150^\circ - x + n \cdot 360^\circ \quad \text{or}$ $3x = 180^\circ - (150^\circ - x) + n \cdot 360^\circ$ ✓✓ both general solutions/ <i>beide algemene oplossings</i> ✓ 37,5° & 15° & -52,5° (-1 per mistake)	
6.5.1	$20^\circ < x < 42,5^\circ$ (graphs shift 5° to the right)	✓ 20°, ✓ 42,5° ✓ Notasie	(3)
6.6	$\cos(x - 60^\circ + 45^\circ)$ $= \cos(x - 15^\circ)$	✓ 45° ✓ answer / antwoord	(2)

2016 Western Cape Preliminary Paper 2 Q 6

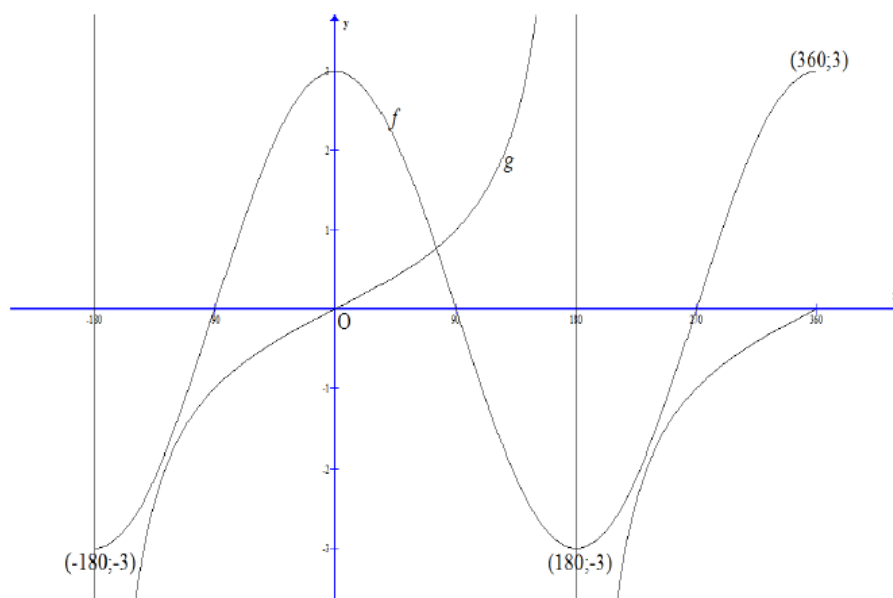
6.1		✓ shape / <i>vorm</i> ✓ endpoints/ <i>eindpunte</i> ✓ intercepts with axes/ <i>snypunte met asse</i>	(3)
6.2	$-\sin 2x = \cos(x - 60^\circ)$ $-\sin 2x = \sin(90^\circ - (x - 60^\circ))$ $-\sin 2x = \sin(150^\circ - x)$ $\sin(180^\circ + 2x) = \sin(150^\circ - x)$ $180^\circ + 2x = 150^\circ - x + n(360^\circ), n \in \mathbb{Z}$ $3x = -30 + n(360), n \in \mathbb{Z}$ $x = -10^\circ + n(120^\circ)$	✓ equate the equations / <i>vergelyking</i> ✓ co-functions/ <i>ko-funksies</i> $\sin(180^\circ + 2x)$ ✓ ✓✓ Ans/ Antw	(5)
6.4	$-10^\circ \leq x \leq 110^\circ$	✓ Inequality/ <i>Ongelykheid</i> ✓✓ Ans/ Antw	(3)
6.4	$y = -\sin(2x + 30^\circ)$	✓✓ Ans/ Antw	(2)
6.5	g must shift 30° right	✓ 30° ✓ right/regs	(2)

2016 Mpumalanga Preliminary Paper 2 Q 6

6.1.1	$2 \cos \theta = \sin(\theta + 30^\circ)$ $= \sin \theta \cos 30^\circ + \cos \theta \sin 30^\circ$ $= \frac{\sqrt{3}}{2} \sin \theta + \frac{1}{2} \cos \theta$ $\therefore 4 \cos \theta = \sqrt{3} \sin \theta + \cos \theta$ $\therefore 3 \cos \theta = \sqrt{3} \sin \theta$	✓ expansion ✓ substitution of special angles ✓ $4 \cos \theta = \sqrt{3} \sin \theta + \cos \theta$ (3)
6.1.2	$3 \cos \theta = \sqrt{3} \sin \theta$ $\frac{\sin \theta}{\cos \theta} = \frac{3}{\sqrt{3}}$ $\tan \theta = \frac{3}{\sqrt{3}}$ $\theta = 60^\circ + 180^\circ n$ $\theta = -120^\circ \text{ or } \theta = 60^\circ$	✓ division ✓ $\tan \theta = \frac{3}{\sqrt{3}}$ ✓✓ answers (4)
6.2.1		$g :$ ✓ y-intercept and x-intercepts ✓ shape $f :$ ✓ y-intercept and x-intercepts ✓ turning points ✓ shape (5)
6.2.2	$-30^\circ < \theta < 90^\circ$	✓✓ values ✓ notation (3)
6.2.3	$-120^\circ < \theta < 60^\circ$	✓✓ values ✓ notation (3)

2016 Kwazulu Natal Preliminary Paper 2 Q 6

6.1



A✓ asymptotes
A✓ shape of f
A✓ shape of g
A✓ correct x - intercept
of f (-90° ; 90° ; 270°)
A✓ correct x – intercept
of g (0° ; 360°)
(5)

6.2 360°

A✓ 360°
(1)

6.3 $(0; 3)$ and $(180^\circ; -3)$
 $(-180^\circ; -3)$ and $(360^\circ; 3)$

CA✓ for any two
(2)

6.4 $-180^\circ < x < 0^\circ$ or $180^\circ < x < 360^\circ$
OR
 $-180^\circ < x < 0^\circ \cup 180^\circ < x < 360^\circ$

CA✓ $-180^\circ < x < 0^\circ$
CA✓ $180^\circ < x < 360^\circ$
[penalize one mark for
incorrect notation]
(2)

6.5 $y = 3\cos(x - 45^\circ)$

A✓ $3\cos(x - 45^\circ)$
(1)

2016 Gauteng Preliminary Paper 2 Q 6.3

6.3.1	$y \in [-2; 2]$ OR / OF $-2 \leq y \leq 2$	✓ $y \in [-2; 2]$ (1)
6.3.2		✓ x-intercepts ✓ y-intercept ✓ shape (3)
6.3.3	360°	✓ 360° (1)
6.3.4	$-120^\circ < x < 60^\circ$ OR / OF $x \in (-120^\circ; 60^\circ)$	✓ $-120^\circ < x$ ✓ $x < 60^\circ$ (2)
6.3.5	$-30^\circ < x < 90^\circ$ OR / OF $x \in (-30^\circ; 90^\circ)$ Brackets/ Inequality signs have to be correct.	✓ $-30^\circ < x$ ✓ $x < 90^\circ$ (2)

2016 Eastern Cape Preliminary Paper 2 Q 6

6.1	$\sin(x + 60^\circ) = \sin(90^\circ - 2x)$ $\therefore x + 60^\circ = 90^\circ - 2x + 360^\circ.k$ or/af $x + 60^\circ = 180^\circ - (90^\circ - 2x) + 360^\circ.k$ $3x = 30^\circ + 360^\circ.k$ or/af $x = -30^\circ + 360^\circ.k$ $x = 10^\circ + 120^\circ.k$; $k \in \mathbb{Z}$ $\therefore x = -30^\circ ; 10^\circ ; 130^\circ$ OR/OF $\cos 2x = \cos(30^\circ - x)$ $2x = 30^\circ - x + 360^\circ.k$ or $2x = -(30^\circ - x) + 360^\circ.k ; k \in \mathbb{Z}$ $3x = 30^\circ + 360^\circ.k$ or $x = -30^\circ + 360^\circ.k$ $\therefore x = -30^\circ ; 10^\circ ; 130^\circ$	✓ co-ratio / ko-funksie ✓ both gen. solns <i>beide algemene oplossings</i> ✓ -30° ✓ 10° ✓ 130° ✓ co-ratio / ko-funksie ✓ both gen. solns <i>beide algemene oplossings</i> ✓ -30° ✓ 10° ✓ 130° (5)
-----	--	--

6.2		g: ✓ x-intercept. ✓ x-afsnit ✓ y-intercept. ✓ y-afsnit ✓ shape / vorm f: ✓ x-intercept. ✓ x-afsnit ✓ y-intercept. ✓ y-afsnit ✓ shape / vorm	(6)
6.3	240°	✓ answer / antwoord	(1)
6.4	$h(x) = \cos(2x - 90^\circ) - 1 = \sin 2x - 1$	✓ substitution / vervanging ✓ $\sin 2x - 1$	(2)

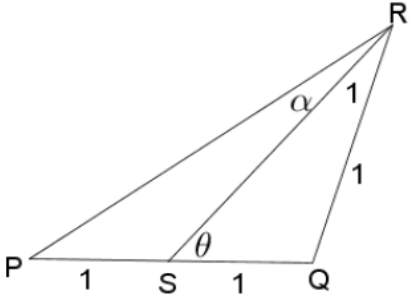
2017 Ekurhuleni North June Paper 2 Q 6

6.1	$2\sin x = \cos(x - 45^\circ)$ $2\sin x = \cos x \cos 45^\circ + \sin x \sin 45^\circ$ $2\sin x = \frac{\sqrt{2}}{2} \cos x - \frac{\sqrt{2}}{2} \sin x$ $2\sin x = \frac{\sqrt{2}}{2} \cos x - \frac{\sqrt{2}}{2} \sin x$ $\frac{4 + \sqrt{2} \sin x}{\frac{\sqrt{2}}{2} \cos x} = 1$ $(-1 + 2\sqrt{2}) \tan x = 1$ $\tan x = \frac{1}{-1 + 2\sqrt{2}}$ $x = 28.68^\circ + k \cdot 180^\circ \quad k \in \mathbb{Z}$	✓ expanding $\checkmark \sin 45^\circ = \frac{\sqrt{2}}{2}$ and $\cos 45^\circ = \frac{\sqrt{2}}{2}$ $\checkmark \tan x = \frac{1}{-1 + 2\sqrt{2}}$ $\checkmark 28.68^\circ$ $\checkmark k \cdot 180^\circ$	(5)
6.2			

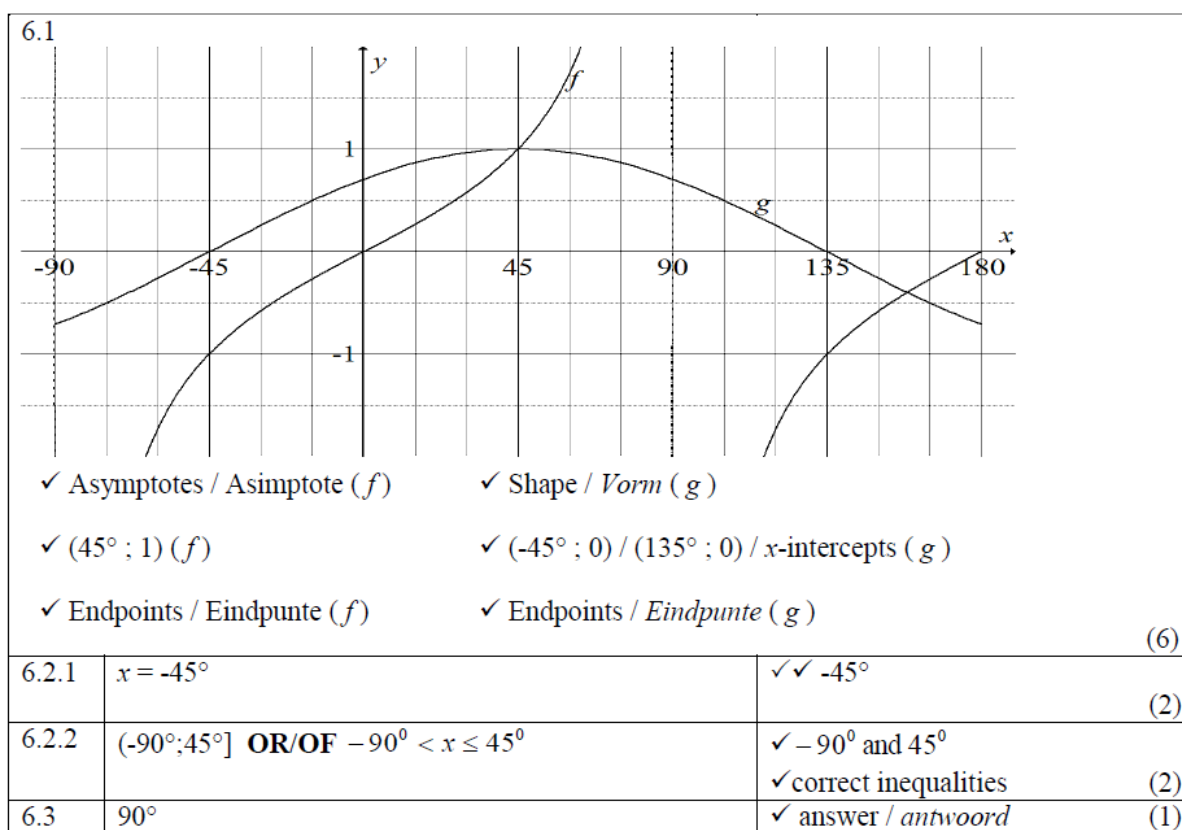
	For f ✓ shape ✓ coordinates of TP ✓ coordinates of intercepts For g ✓ shape ✓ coordinates of TP ✓ coordinates of intercepts	(6)
6.3	$28.68^\circ < x \leq 180^\circ$	✓ 28.68° and 180° ✓ correct inequalities (2)

2017 Johannesburg South Cluster June Paper 2 Q 8

8.1.1	$p = 30^\circ$ $q = -\frac{1}{2}$	✓ $p = 30^\circ$ ✓ $q = -\frac{1}{2}$ (2)
8.1.2	$-120^\circ < x < 0$ or $x \in (-120^\circ; 0^\circ)$	✓ Critical values ✓ intervals (2)
8.1.3	The graph of g has to shift 60° to the left and then reflected about the x -axis	✓ 60° to the left ✓ reflect about x -axis (2)

OR	The graph is reflected about the x -axis then shifted 60° to the left	✓ 60° to the left ✓ reflect about x -axis
OR	The graph of g has to shifted 240° to left	✓✓ shifted 240° to left
8.2		✓ ✓
8.2.1	$\hat{P} = \theta - \alpha$ (Ext $\angle$ of Δ)	✓ $\hat{P} = \theta - \alpha$ (1)
8.2.2	$\hat{R}_1 = \theta$ ($\angle$ s opp = sides of a Δ) In ΔPQR $\frac{\sin \hat{P}}{1} = \frac{\sin \hat{R}_1}{2}$ $\frac{\sin(\theta - \alpha)}{1} = \frac{\sin(\theta + \alpha)}{2}$ $2 \sin(\theta - \alpha) = \sin(\theta + \alpha)$ $2(\sin \theta \cos \alpha - \cos \theta \sin \alpha) = \sin \theta \cos \alpha + \cos \theta \sin \alpha$ $2 \sin \theta \cos \alpha - 2 \cos \theta \sin \alpha = \sin \theta \cos \alpha + \cos \theta \sin \alpha$ $\sin \theta \cos \alpha = 3 \cos \theta \sin \alpha$ $\frac{\sin \theta}{\cos \theta} = 3 \frac{\sin \alpha}{\cos \alpha}$ $\tan \theta = 3 \tan \alpha$	✓ $\hat{R}_1 = \theta$ ✓ $\frac{\sin(\theta - \alpha)}{1} = \frac{\sin(\theta + \alpha)}{2}$ ✓ $2 \sin \theta \cos \alpha - 2 \cos \theta \sin \alpha$ ✓ $\sin \theta \cos \alpha + \cos \theta \sin \alpha$ ✓ $\sin \theta \cos \alpha = 3 \cos \theta \sin \alpha$ ✓ $\frac{\sin \theta}{\cos \theta} = 3 \frac{\sin \alpha}{\cos \alpha}$ (6)

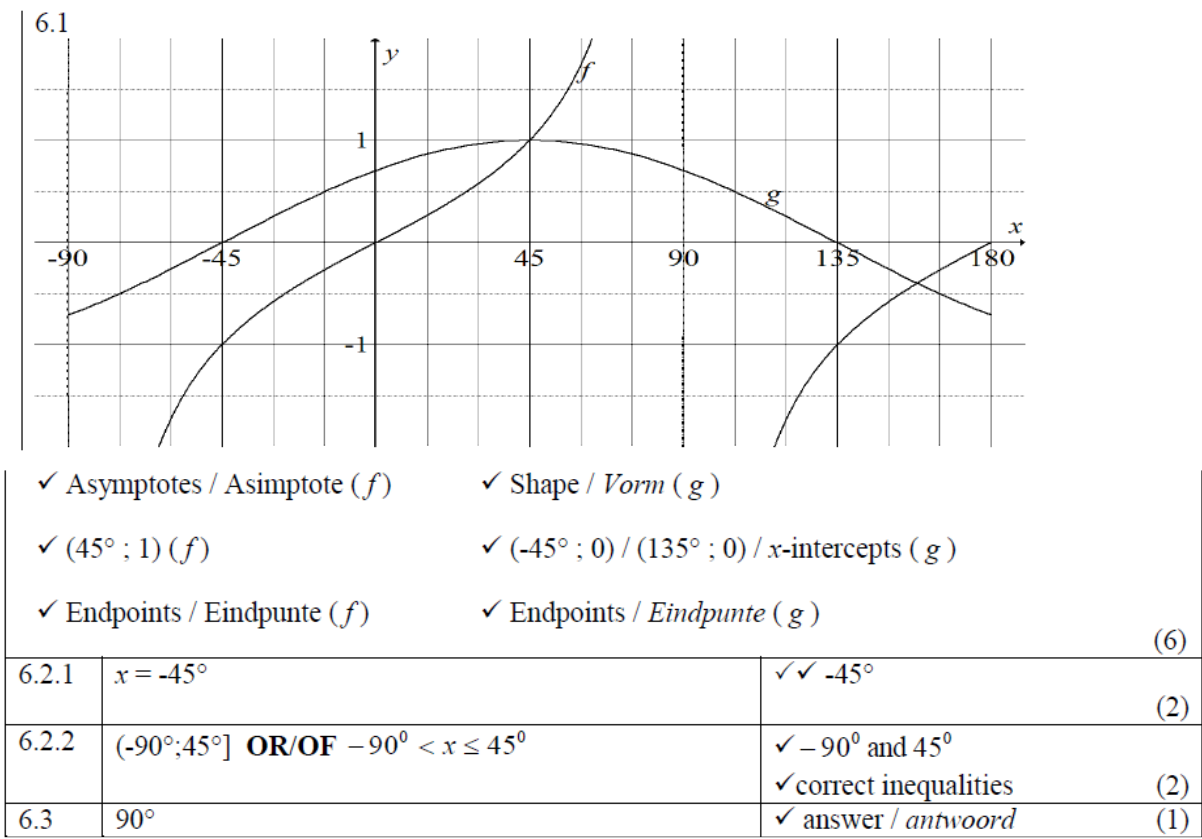
2017 Eastern Cape June Paper 2 Q 6



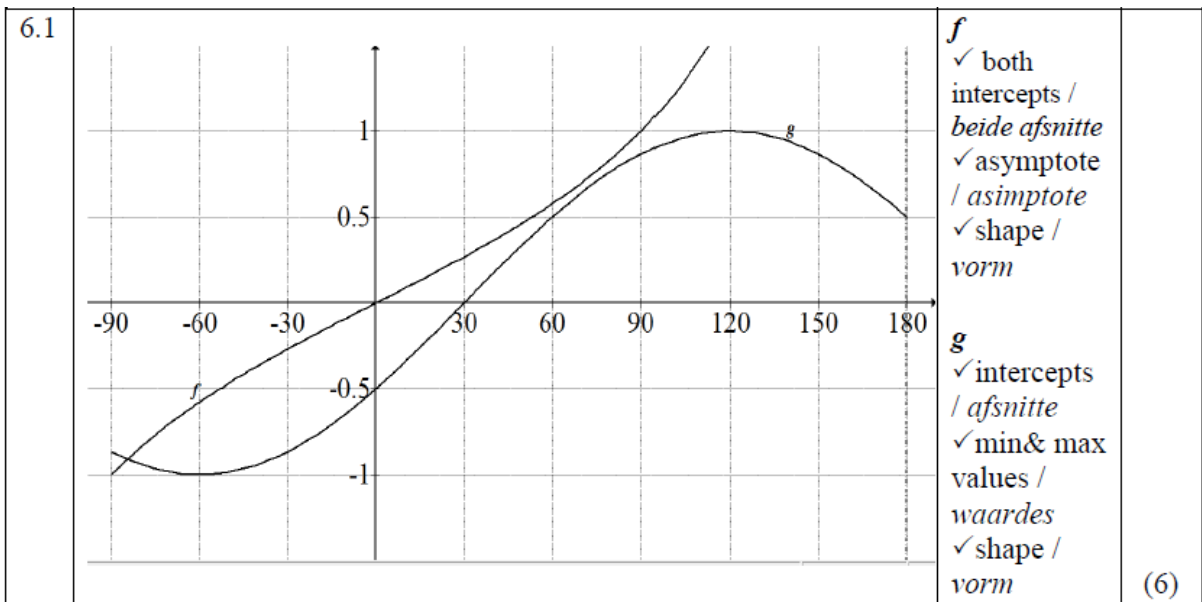
2017 Senior Certificate Paper 2 Q 6

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

2017 Eastern Cape Preliminary Paper 2 Q 6



2017 Gauteng Preliminary Paper 2 Q 6



6.2	Period(e) of/van $f(\frac{1}{2}x) = \frac{180^0}{\frac{1}{2}}$ $= 360^0$	Answer only full marks <i>Slegs antwoord volpunte</i>	✓ $\frac{180^0}{\frac{1}{2}}$ ✓ 360^0	(2)
6.3	$0^0 < x < 30^0$	✓ critical values / <i>kritiese waardes</i> ✓ notation / <i>notasie</i>		(2)
6.4	$x = 170^0$	✓ answer / <i>antwoord</i>		(1)

2018 March Paper 2 Q 5.5

5.5.1	$g(x) = -4\cos(x + 30^0)$ 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	$y = -4\cos(x + 30^0)$ shifted to the left/skuif na links: $y = -4\cos(x + 30^0 + 60^0)$ $= -4\cos(x + 90^0)$ $= 4\sin x$ $\therefore h(x) = -4\sin x$ Answer only: full marks	✓ shift of 60^0 to the left ✓ reduction ✓ equation of h	(3)

2018 Senior Certificate Paper Q 6

6.1	Period = 720^0	✓ answer	(1)
6.2	$y \in [-2 ; 2]$ OR/OF $-2 \leq y \leq 2$	✓✓ answer ✓✓ answer	(2) (2)

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

2018 Eastern Cape Preliminary Paper 2 Q 6

6.1	Amplitude = 2	✓ answer/antwoord	(1)
6.2	$1 \leq y \leq 5$	✓ min & max/maks ✓ notation/notasie	(2)
6.3		✓ both x -intercepts <i>beide x-afsnitte</i> -30° & 150° ✓ max TP & y -intercept ✓ shape / vorm	(3)

6.4	$-30^{\circ} < x < 0^{\circ}$	✓ both c.v.s / beide k.w.s ✓ notation/notasie	(2)
6.5	$h(x) = \sin(x + 90^{\circ}) - 2$ $= \cos x - 2$	✓✓ $\sin(x + 90^{\circ}) - 2$ ✓ $\cos x$	(3)

2018 Overberg District Preliminary Paper 2 Q 6

6.1	$a = 2$	✓ 2	(1)
6.2	Mark f only / Merk slegs vir f	✓ shape / vorm ✓ turning points / draaipunte ✓ x & y intercepts / x & y afsnitte	(3)
6.3	$2 \cos(x - 30^{\circ}) = 2 \sin x$ $\cos(x - 30^{\circ}) = \sin x$ $\sin [90 - (x - 30^{\circ})] = \sin x$ $(-x + 120^{\circ}) = x$ $120^{\circ} - x = x$ of/or $120^{\circ} - x = 180^{\circ} - x$ $2x = 120^{\circ} + k360^{\circ}$ $x = 60^{\circ} + k180^{\circ}$ $\therefore x = -120^{\circ}; 60^{\circ}$ OR $\cos(x - 30^{\circ}) = \sin x$ $\cos(x - 30^{\circ}) = \cos(90^{\circ} - x)$ $x - 30^{\circ} = 90^{\circ} - x$ $2x = 120^{\circ} + k360^{\circ}$ $x = 60^{\circ} + k180^{\circ}$ $\therefore x = -120^{\circ}, 60^{\circ}$	✓ co-function ✓ $x = (-x + 120^{\circ})$ ✓ $2x = 120^{\circ} + k360^{\circ}$ or/of $x = 60^{\circ} + k180^{\circ}$ ✓✓ $x = -120^{\circ}, 60^{\circ}$ OR ✓ co-function ✓ $x - 30^{\circ} = 90^{\circ} - x$ ✓ $2x = 120^{\circ} + k360^{\circ}$ or/of $x = 60^{\circ} + k180^{\circ}$ ✓✓ $x = -120^{\circ}, 60^{\circ}$	(5)
6.4	$k = 3$	✓ 3	(1)
6.5	f shifted 60° to the right	✓ 60° ✓ to the right	(2)

2018 North West Preliminary Paper 2 Q 6

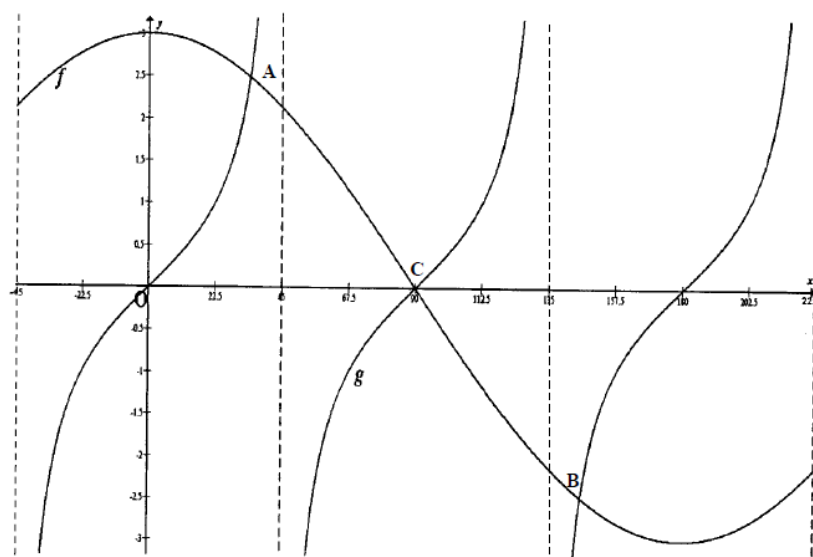
6.1	$p = 30^\circ$ and / en $q = -\frac{1}{2}$	$\checkmark\checkmark p = 30^\circ$ $\checkmark\checkmark q = -\frac{1}{2}$ (4)
6.2	$x = -150^\circ$ or / of $x = 30^\circ$	$\checkmark -150^\circ$ $\checkmark 30^\circ$ (2)
6.3	The graph of f must be translated 60° to the left / <i>Die grafiek van f moet 60° na links getransleer word.</i> OR/OF The graph of f must be translated 120° to the right and then be reflected about the x-axis/ <i>Die grafiek van f moet 120° na regs getransleer word en dan in die x-as gereflekteer word.</i>	$\checkmark\checkmark 60^\circ$ to the left/ <i>na links</i> (2) $\checkmark 120^\circ$ right/ <i>regs</i> $\checkmark$ reflect about x -axis/ <i>reflekteer in die x-as.</i>

2018 Free State Preliminary Paper 2 Q 8

8.1	$a = 1$ $b = 2$ $c = 2$ $d = 1$	$\checkmark a = 1$ $\checkmark b = 2$ $\checkmark c = 2$ $\checkmark d = 1$ (4)
8.2	$P(21,44^\circ; 0,73)$	$\checkmark$ correct substitution (2)
8.3.1	$x = 90^\circ$	$\checkmark 90^\circ$ (1)
8.3.2	$x \in [45^\circ; 135^\circ]$ OR $45^\circ \leq x \leq 135^\circ$	$\checkmark 45^\circ$ and 135° $\checkmark$ Notation (2)

2018 Kwazulu Natal Preliminary Paper 2 Q 6

6.1



- ✓ A shape of f
- ✓ A shape of g
- ✓✓ A A asymptotes
- ✓ A x -intercepts of f
- ✓ A Turning points of f
- ✓ A x -intercepts of g
- ✓ A 3 intersection points

(8)

6.2

the graphs intersect at A, B and C. At A we have $x = 34^\circ$, at C we have $x = 90^\circ$ and by using symmetry we get at B, $x = 180^\circ - 34^\circ = 146^\circ$.

✓ A using symmetry

✓ A answer

Answer only full marks

(2)

[10]

2018 Eastern Cape Preliminary Paper 2 Q 6

6.1

$$a = -2$$

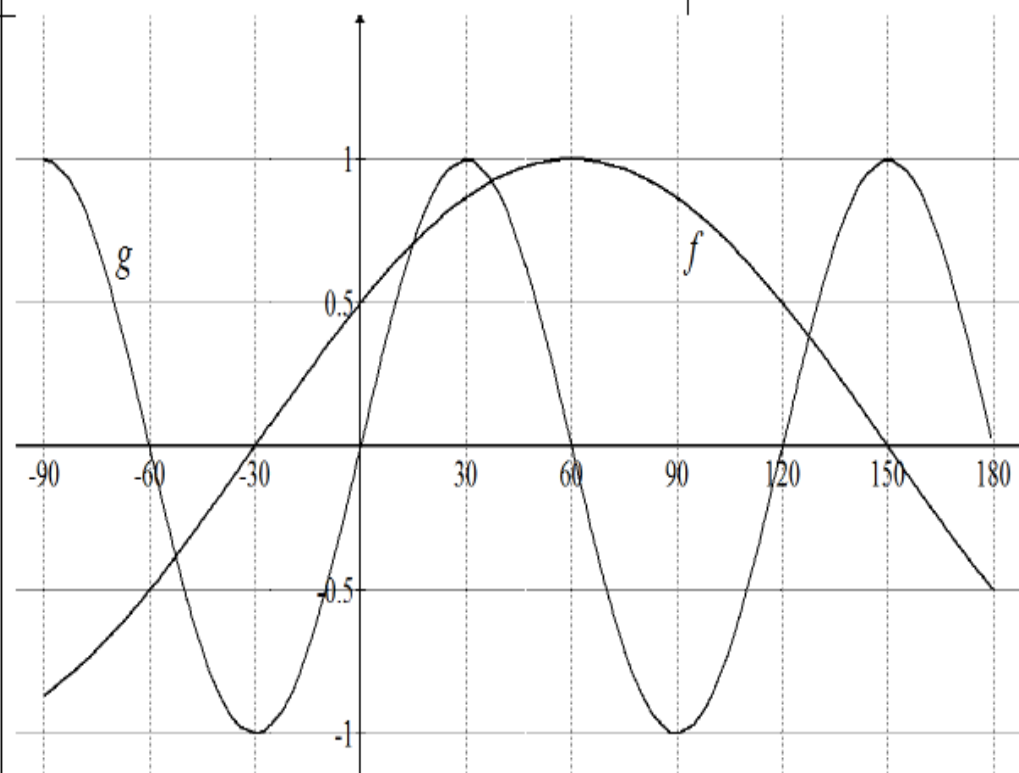
$$p = 30^\circ$$

$$\checkmark a = -2$$

$$\checkmark p = 30^\circ$$

(2)

6.2

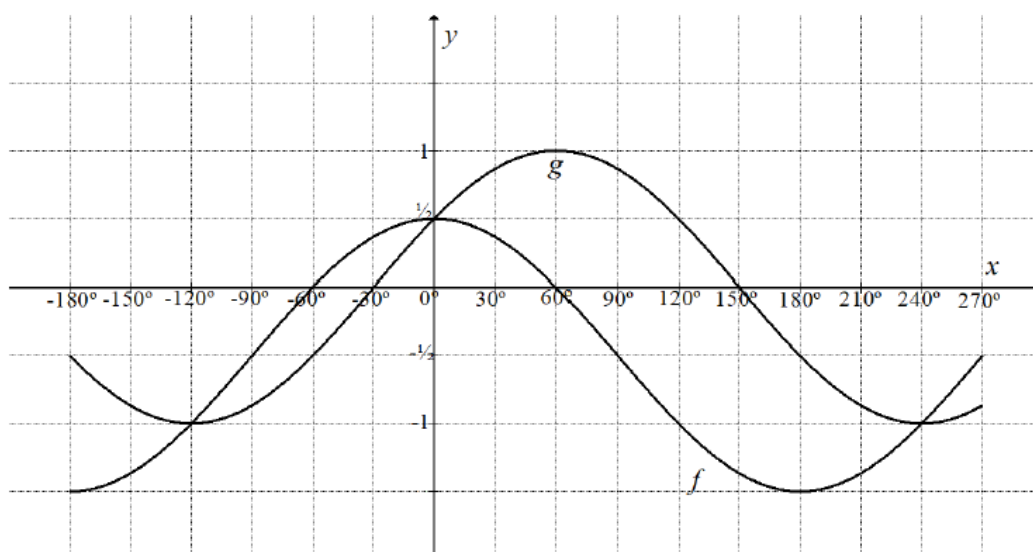


6.2.1	$x = 60^\circ$	✓	(1)
6.2.2	$\cos(x - 60^\circ) = \sin 3x$ $\cos(x - 60^\circ) = \cos(90^\circ - 3x)$ $x - 60^\circ = \pm(90^\circ - 3x) + 360^\circ \cdot k \quad k \in \mathbb{Z}$ $\therefore 4x = 150^\circ + 360^\circ \cdot k$ OR $-2x = -30^\circ + 360^\circ \cdot k \quad k \in \mathbb{Z}$ $\therefore x = 37,50^\circ + 90^\circ \cdot k \quad \text{or} \quad x = 15^\circ - 180^\circ \cdot k$ $\therefore x = -52,50^\circ \text{ and } x = 15^\circ$	✓ co-function <i>ko-funksie</i> ✓ ref $\angle$ ✓ $4x = 150^\circ + 360^\circ \cdot k$ ✓ & $-2x = -30^\circ + 360^\circ \cdot k$ ✓ $x = 15^\circ$ ✓ $x = -52,50^\circ$	(6)
6.2.3	$-52,50^\circ < x < 15^\circ$	✓ both critical values <i>beide kritiese waardes</i> ✓ notation / <i>notasie</i>	(2)

2018 Mpumalanga Preliminary Paper 2 Q 6

6.1		$f(x)$ ✓ shape ✓ x-intercepts ✓ y-intercepts ✓ turning point (4)
6.2	$g(2x) = -\cos 2x$ $\therefore \text{period} = 180^\circ$	✓ $g(2x) = -\cos 2x$ ✓ answer (2)
6.3	$0^\circ < x < 60^\circ$ OR $x \in (0^\circ; 60^\circ)$	✓ notation ✓ end points (2)

2018 Limpopo Preliminary Paper 2 Q 6



6.1	Graph done/Grafiek geskets	<i>g</i> : ✓ intercepts/as – afsnitte ✓ turning points/draaipunte ✓ shape/vorm (3)
6.2.1	$x \in (-120^\circ; 0^\circ) \cup (240^\circ; 270^\circ]$	✓ $(-120^\circ; 0^\circ)$ ✓ $(240^\circ; 270^\circ]$ ✓ notation /notasie (3)
6.2.2	$x \in [-180^\circ; -60^\circ] \cup [-30^\circ; 60^\circ] \cup [150^\circ; 270^\circ]$	✓ $x \in [-180^\circ; -60^\circ]$ ✓ $[-30^\circ; 60^\circ]$ ✓ $[150^\circ; 270^\circ]$ (3)
6.3	$y = \sin(x + 30^\circ - 120^\circ)$ $= \sin(x - 90^\circ)$ $= -\cos x$	✓ $y = \sin(x + 30^\circ - 120^\circ)$ ✓ answer/antwoord (2)

2018 Gauteng Preliminary Paper 2 Q 6

6.1	$x = -45^\circ$	✓ $x = -45^\circ$ (has to be an equation $x = \dots$) (1)
6.2	$h(x) = \frac{\sin x - 2 \sin^3 x}{2 \sin^2 x \cos x}$ $= \frac{\sin x(1 - 2 \sin^2 x)}{2 \sin^2 x \cos x}$ $= \frac{(1 - 2 \sin^2 x)}{2 \sin x \cos x}$ $= \frac{\cos 2x}{\sin 2x}$ $= \frac{1}{\tan 2x}$ $= \frac{1}{f(x)}$	✓ $\sin x(1 - 2 \sin^2 x)$ ✓ $\cos 2x$ ✓ $\sin 2x$ ✓ $\frac{1}{f(x)}$ (4)

6.3	$p(x) = 1 + \sin 2(x + 45^\circ)$ $= 1 + \sin(2x + 90^\circ)$ $= 1 + \cos 2x$	$\checkmark 1 + \sin 2(x + 45^\circ)$ $\checkmark \sin(2x + 90^\circ)$ $\checkmark 1 + \cos 2x$ (3)
6.4	$(\tan 2x)(-1 - \sin 2x) \leq 0$ $(\tan 2x)(1 + \sin 2x) \geq 0$ $-90^\circ \leq x < -45^\circ$ or $[-90^\circ; -45^\circ)$	$\checkmark (\tan 2x)(1 + \sin 2x) \geq 0$ $\checkmark -90^\circ \leq x$ $\checkmark x < -45^\circ$ (3)