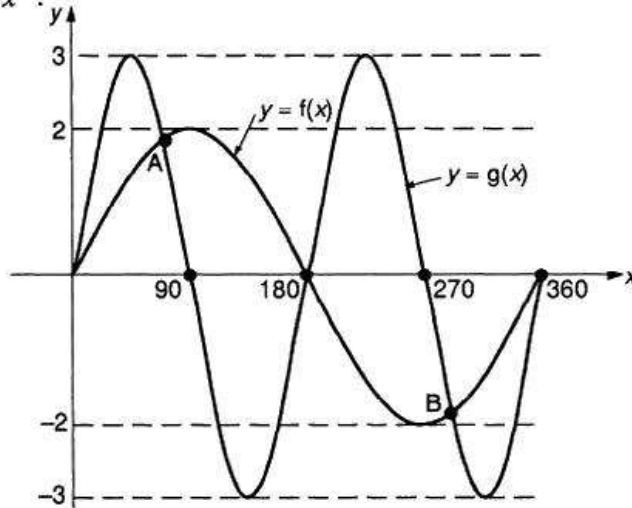


Trigonometry Calculator C Grade

- [SQA] 1. (a) Solve the equation $3\sin 2x^\circ = 2\sin x^\circ$ for $0 \leq x \leq 360$ (4)
- (b) The diagram below shows parts of the graphs of sine functions f and g . State expressions for $f(x)$ and $g(x)$. (1)
- (c) Use your answers to part (a) to find the co-ordinates of A and B. (2)
- (d) Hence state the values of x in the interval $0 \leq x \leq 360$ for which $3\sin 2x^\circ < 2\sin x^\circ$. (3)



Part	Marks	Level	Calc.	Content	Answer	U2 OC3
(a)	4	C	CR	T10		1992 P2 Q7
(b)	1	C	CR	A7		
(c)	2	C	CR	A6		
(d)	2	C	CR	T2		
(d)	1	A/B	CR	T2		

(a) •¹ strategy: ie $\sin 2x = 2\sin x \cos x$
 •² $\sin x = 0$ AND $\cos x = \frac{1}{3}$
 •³ 0, 180 AND 360
 •⁴ 70.5 AND 289.5 AND NO other angles

(b) •⁵ $f(x) = 2 \sin x^\circ$, $g(x) = 3 \sin 2x^\circ$

(c) •⁶ $x = 70.5$ AND 289.5
 •⁷ $y = 1.89$ AND -1.89

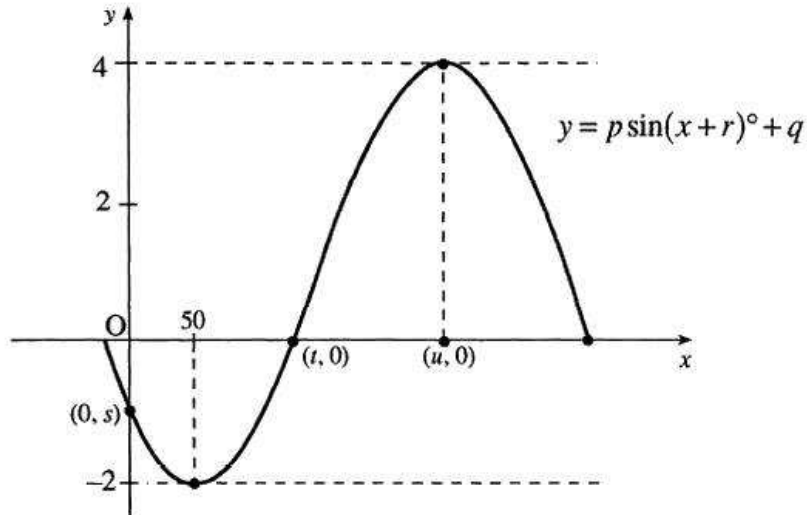
(d) •⁸ 70.5 AND 180
 •⁹ 289.5 AND 360
 •¹⁰ use inequality signs logically to connect the points of intersection (ie not for $180 < x < 70.5$)

[SQA]

2. The sketch represents part of the graph of a trigonometric function of the form $y = p \sin(x+r)^\circ + q$. It crosses the axes at $(0, s)$ and $(t, 0)$, and has turning points at $(50, -2)$ and $(u, 4)$.

(i) Write down values for p, q, r and u . (4)

(ii) Find the values for s and t . (4)

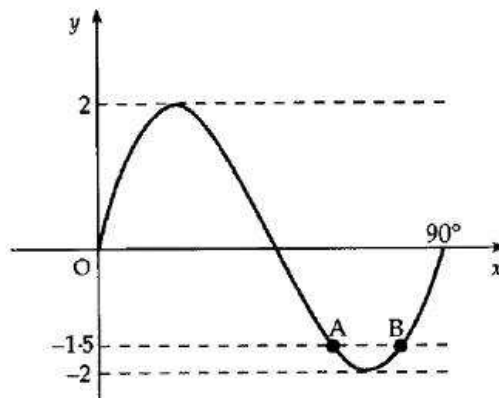


Part	Marks	Level	Calc.	Content	Answer	U2 OC3
(a)	2	C	CR	T1		1997 P2 Q9
(a)	2	A/B	CR	T1		
(b)	4	A/B	CR	T7		

- (a)
- ¹ $p = -3$
 - ² $q = 1$
 - ³ $r = 40$ or -320
 - ⁴ $u = 230$

- (b)
- ⁵ replace x by 0
 - ⁶ -0.928
 - ⁷ replace y by 0
 - ⁸ 120.5

- [SQA] 3. The diagram shows the graph of a sine function from 0° to 90° .
- (a) State the equation of the graph.
- (b) The line with equation $y = -1.5$ intersects the curve at A and B.
Find the coordinates of A and B.



2

3

Part	Marks	Level	Calc.	Content	Answer	U2 OC3
(a)	2	C	CR	T1, A7		1990 P1 Q10
(b)	3	C	CR	T7		

• ¹ $\sin 4x$
• ² (trig function) $\times 2$
• ³ $f(x) = -1.5$
• ⁴ 57.1°
• ⁵ 77.9°

- [SQA] 4. Solve the equation $\cos 2x^\circ + 5 \cos x^\circ - 2 = 0$, $0 \leq x < 360$.

5

Part	Marks	Level	Calc.	Content	Answer	U2 OC3
	1	C	CR	T10		1994 P1 Q15
	4	A/B	CR	T10		

• ¹ Replacing $\cos 2x$ by $2 \cos^2 x - 1$	• ⁵ 300°
• ² $2 \cos^2 x + 5 \cos x - 3 = 0$	and no extraneous solutions
• ³ $(2 \cos x - 1)(\cos x + 3) = 0$	and no solution for $\cos x = -3$ indicated.
• ⁴ 60°	[If a reason is given, it must be valid].

5. Solve $2 \cos 2x - 5 \cos x - 4 = 0$ for $0 \leq x < 2\pi$.

5

Part	Marks	Level	Calc.	Content	Answer	U2 OC3	
	5	B	CN	T10, T7	$x = 2.419, 3.864$	2010 P2 Q4	
				<ul style="list-style-type: none"> •¹ ss: know to use double angle formula •² ic: express as quadratic in $\cos x$ •³ ss: start to solve •⁴ pd: reduce to equations in $\cos x$ only •⁵ pd: complete solutions to include only one where $\cos x = k$ with $k > 1$ 	<ul style="list-style-type: none"> •¹ $2 \times (2 \cos^2 x - 1) \dots$ •² $4 \cos^2 x - 5 \cos x - 6 = 0$ •³ $(4 \cos x + 3)(\cos x - 2) = 0$ •⁴ $\cos x = -\frac{3}{4}$ and $\cos x = 2$ •⁵ $2.419, 3.864$ and no solution. 		

[SQA] 6. Express $8 \cos x^\circ - 6 \sin x^\circ$ in the form $k \cos(x^\circ + a^\circ)$ where $k > 0$ and $0 < a < 360$.

4

Part	Marks	Level	Calc.	Content	Answer	U3 OC4	
	4	C	CR	T13	$10 \cos(x^\circ + 36.9^\circ)$	2001 P2 Q5	
				<ul style="list-style-type: none"> •¹ ss: expand $k \cos(x^\circ + a^\circ)$ •² ic: compare coefficients •³ pd: process •⁴ pd: process 	<ul style="list-style-type: none"> •¹ $k \cos x \cos a - k \sin x \sin a$ <i>stated explicitly</i> •² $k \cos a = 8$ and $k \sin a = 6$ <i>stated explicitly</i> •³ $k = 10$ •⁴ $a = 36.9$ 		

7. (a) $12 \cos x^\circ - 5 \sin x^\circ$ can be expressed in the form $k \cos(x + a)^\circ$, where $k > 0$ and $0 \leq a < 360$.

Calculate the values of k and a .

4

- (b) (i) Hence state the maximum and minimum values of $12 \cos x^\circ - 5 \sin x^\circ$.

- (ii) Determine the values of x , in the interval $0 \leq x < 360$, at which these maximum and minimum values occur.

3

Part	Marks	Level	Calc.	Content	Answer	U3 OC4
(a)	4	C	CN	T13	$k = 13, a = 22.6$	2010 P2 Q2
(bi)	1	C	CN	T14	max 13, min -13	
(bii)	2	C	CN	T14	max at 337.4, min at 157.4	

<ul style="list-style-type: none"> •¹ ss: use addition formula •² ic: compare coefficients •³ pd: process k •⁴ pd: process a •⁵ ss: state maximum and minimum •⁶ ic: find x corresponding to max. value •⁷ pd: find x corresponding to min. value 	<ul style="list-style-type: none"> •¹ $k \cos x^\circ \cos a^\circ - k \sin x^\circ \sin a^\circ$ •² $k \cos a^\circ = 12$ and $k \sin a^\circ = 5$ •³ 13 (do not accept $\sqrt{169}$) •⁴ 22.6 (accept any answer which rounds to 23) •⁵ 13, -13 •⁶ maximum at 337.4 and no others •⁷ minimum at 157.4 and no others
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- [SQA] 8. (a) Express $3\sin x^\circ - \cos x^\circ$ in the form $k\sin(x - \alpha)^\circ$, where $k > 0$ and $0 \leq \alpha \leq 90$. (4)
- (b) Hence find algebraically the values of x between 0 and 180 for which $3\sin x^\circ - \cos x^\circ = \sqrt{5}$. (4)
- (c) Find the range of values of x between 0 and 180 for which $3\sin x^\circ - \cos x^\circ \leq \sqrt{5}$. (2)

Part	Marks	Level	Calc.	Content	Answer	U3 OC4
(a)	4	C	CR	T13		1994 P2 Q5
(b)	4	C	CR	T16		
(c)	2	A/B	CR	T16		

(a)	• ¹	$k(\sin x \cos \alpha - \cos x \sin \alpha)$ or equivalent
	• ²	$k \cos \alpha = 3$ and $k \sin \alpha = 1$
	• ³	$k = \sqrt{10}$
	• ⁴	$\alpha = 18.4$
(b)	• ⁵	$\sqrt{10} \sin(x - 18.4)^\circ = \sqrt{5}$
	• ⁶	$\sin(x - 18.4)^\circ = \frac{1}{\sqrt{2}}$ or equivalent
	• ⁷	63.4
	• ⁸	153.4
(c)	• ⁹	strategy stated or implied
	• ¹⁰	$x \leq 63.4$ and $x \geq 153.4$

- [SQA] 9. $f(x) = 2\cos x^\circ + 3\sin x^\circ$.
- (a) Express $f(x)$ in the form $k\cos(x - \alpha)^\circ$ where $k > 0$ and $0 \leq \alpha < 360$. (4)
- (b) Hence solve algebraically $f(x) = 0.5$ for $0 \leq x < 360$. (3)

Part	Marks	Level	Calc.	Content	Answer	U3 OC4
(a)	4	C	CR	T13		1996 P2 Q7
(b)	3	C	CR	T16		

(a)	<ul style="list-style-type: none"> •¹ $k \cos x \cos \alpha + k \sin x \sin \alpha$ •² $k \cos \alpha = 2$ and $k \sin \alpha = 3$ •³ $k = \sqrt{13}$ •⁴ $\alpha = 56.3$
(b)	<ul style="list-style-type: none"> •⁵ $\cos(x - 56.3)^\circ = \frac{0.5}{\sqrt{13}}$ •⁶ $x - 56.3 = 82.0, 278.0$ •⁷ $x = 138.3, 334.3$

10. Given that $f(x) = (4 - 3x^2)^{-\frac{1}{2}}$ on a suitable domain, find $f'(x)$.
- A. $-3x(4 - 3x^2)^{-\frac{1}{2}}$
- B. $-\frac{1}{2}(4 - 6x)^{-\frac{3}{2}}$
- C. $2(4 - 3x^3)^{\frac{1}{2}}$
- D. $3x(4 - 3x^2)^{-\frac{3}{2}}$

2

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
D	3.2	C	0	0	NC	C21	2009 P1 Q18

[SQA] 11. Given that $f(x) = (5x - 4)^{\frac{1}{2}}$, evaluate $f'(4)$.

3

Part	Marks	Level	Calc.	Content	Answer	U3 OC2
	1	C	CN	C21	$\frac{5}{8}$	2000 P2 Q8
	2	A/B	CN	C21		

<ul style="list-style-type: none"> •¹ pd: differentiate power •² pd: differentiate 2nd function •³ pd: evaluate $f'(x)$ 	<ul style="list-style-type: none"> •¹ $\frac{1}{2}(5x - 4)^{-\frac{1}{2}}$ •² $\times 5$ •³ $f'(4) = \frac{5}{8}$
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[SQA] 12. Differentiate $2x^{\frac{3}{2}} + \sin^2 x$ with respect to x .

4

Part	Marks	Level	Calc.	Content	Answer	U3 OC2
	1	C	NC	C21		1992 P1 Q11
	3	A/B	NC	C21		

<ul style="list-style-type: none"> •¹ $3x^{\frac{1}{2}}$ •² $(\sin x)^2$ stated or implied by •³ •³ $2 \sin x$ •⁴ $\times \cos x$
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[SQA] 13. Find the derivative, with respect to x , of $\frac{1}{x^3} + \cos 3x$.

4

Part	Marks	Level	Calc.	Content	Answer	U3 OC2
	4	A/B	NC	C21		1994 P1 Q10

<ul style="list-style-type: none"> •¹ x^{-3} stated or implied by •² •² $-3x^{-4}$ •³ $-\sin 3x$ •⁴ $\times 3$

[SQA] 14. If $f(x) = \cos^2 x - \frac{2}{3x^2}$, find $f'(x)$.

4

Part	Marks	Level	Calc.	Content	Answer	U3 OC2
	2	C	NC	C21, C1		1990 P1 Q19
	2	A/B	NC	C21, C1		

- ¹ $-\frac{2}{3}x^{-2}$
- ² $2\cos x$
- ³ $\times(-\sin x)$
- ⁴ $\frac{4}{3}x^{-3}$

[SQA] 15. Differentiate $4\sqrt{x} + 3\cos 2x$ with respect to x .

4

Part	Marks	Level	Calc.	Content	Answer	U3 OC2
	2	C	NC	C21, C1		1993 P1 Q9
	2	A/B	NC	C21, C1		

- ¹ $4x^{\frac{1}{2}}$
- ² $2x^{-\frac{1}{2}}$
- ³ $-\sin 2x$
- ⁴ $\times 2$

[END OF QUESTIONS]