

GRAPHS OF TRIGONOMETRY EQUATIONS

KCSE 1989 – 2012 Form 4 Mathematics
Answer all the questions

1. **1989 Q23 P2**

Complete the table given below by filling in the blank boxes.

x°	$3 \cos x^\circ$	$4 \sin(2x - 10^\circ)$
0°	3.0	-0.69
15°		1.37
30°	2.60	
45°		3.94
60°	1.50	3.76
75°		
90°	0	0.69
105°	-0.75	
120°		-3.06
135°		
150°		-3.76
165°		
180°	-3.0	-0.69

Taking 1 cm to represent 15° on the x-axis and 2cm to represent 1 unit on the y axis, draw the graph of $y = 3 \cos x$ and $y = 4 \sin(2x - 10^\circ)$ using the same axes on the graph provided.

Use your graph to find the value of x for which
 $3 \cos x = 4 \sin(2x - 10^\circ)$ (8marks)

2. **1990 Q19 P1**

Copy and complete the table given below.

x°	$\sin(x+30^\circ)$	$\cos(x-15^\circ)$
0°	0	
30°	0.5	0.97
60°	0.87	
90°		
120°		
150°		
180°		
210°		
240°		

Using the same axes plot the curves $y = \sin(x+30^\circ)$ and $y = \cos(x - 15^\circ)$ For $-30^\circ \leq x \leq 240^\circ$ (3 marks)

Use your graph to find the value of x such that $\cos(x-15^\circ) = \sin(x+30^\circ)$ (2marks)

3. **1991 Q18 P1**
 a) Complete the table given below by filling in the blank boxes. (2marks)

x°	$3 \sin x^\circ - 1$	$\cos x^\circ$
0°	-1	1
30°	0.5	0.87
60°		0.5
90°		0
120°		
150°		-0.87
180°		-1
210°		
240°		

- b) On the same axes draw the graph of $y = 3 \sin x^\circ - 1$ and $y = \cos x^\circ$ on the grid below. (grid was provided) (4marks)
 c) Use your graph to solve the equation $3 \sin x^\circ - \cos x^\circ = 1$ (2marks)

4. **1993 Q23 P1**
 Complete the table below by filling in the blank spaces.

x°	$2 \sin x$	$\cos 2x$
-180°		
-135°		
-90°		
-45°		
0°	0	1
45°		
90°		
135°		
180°		

Draw the graph of $y = 2 \sin x$ and $y = \cos 2x$ using the axes on the grid provided. (2marks)

- a) What is the difference in the values of $y = 2 \sin x$ and $y = \cos 2x$ at $x = 67\frac{1}{2}^\circ$? (2marks)
 b) State the periods of
 i) $y = 2 \sin x$ (1 mark)
 ii) $y = \cos 2x$ (1 mark)

5. **1995 Q 23 P2**
 (a) Complete the table for the function $y = 2 \sin x$ (2 marks)

x°	$\sin 3x$	y
0°	0	0
10°	0.5000	1.00
20°		
30°		
40°		
50°		
60°		
70°		
80°	-0.8666	-1.73
90°		
100°		
110°		
120°		

(b)(i) Using the values in the completed table, draw the graph of $y = 2 \sin 3x$ for $0^\circ \leq x \leq 120^\circ$ on the grid provided
(ii) Hence solve the equation $2 \sin 3x = -1.5$ (3 marks)

6. **1996 Q 24 P2**

Complete the table given below for the functions:
 $y = -3 \cos 2x^\circ$ and $y = 2 \sin (\frac{3}{2}x^\circ + 30^\circ)$ for $0^\circ \leq x \leq 180^\circ$ (2 mks)

x°	$-3 \cos 2x^\circ$	$2 \sin(\frac{3}{2}x^\circ + 30^\circ)$
0°	-3.00	1.00
20°		
40°		2.00
60°	1.50	1.73
80°	2.82	
100°	2.82	0.00
120°		-1.00
140°	-0.52	
160°	-2.30	
180°		-1.73

a) Using the grid provided, draw the graphs of $y = -3 \cos 2x^\circ$ and $y = 2 \sin (\frac{3}{2}x^\circ + 30^\circ)$ on the same axis. Take 1 cm to represent 20° on the x-axis and 2cm to represent one unit on the y-axis (4 mks)

b) From your graphs, find the roots of $3 \cos 2x^\circ + 2 \sin (\frac{3}{2}x^\circ + 30^\circ) = 0$. (2mks)

7. **1997 Q 18 P2**

Complete the table below by filling in the blank spaces

x°	$\cos x^\circ$	$2 \cos \frac{1}{2} x^\circ$
0°	1.00	2.00
30°	0.87	1.93
60°	0.50	1.73
90°	0	1.41
120°	-0.5	1.0
150°	-0.87	0.52
180°	-1.0	0
210°	0.87	0.52
240°	-0.5	-1.00
270°	0	1.47
300°	0.5	1.73
330°	0.87	1.93
360°	1	-2.00

Using the scale 1 cm to represent 30° on the horizontal axis and 4 cm to represent 1 unit on the vertical axis draw, on the grid provided, the graphs of $y = \cos x^\circ$ and $y = 2 \cos \frac{1}{2} x^\circ$ on the same axis.

(a) Find the period and the amplitude of $y = 2 \cos \frac{1}{2} x^\circ$

(b) Describe the transformation that maps the graph of $y = \cos x^\circ$ on the graph of $y = 2 \cos \frac{1}{2} x^\circ$

8. **1998 Q 18 P2**
 (a) Complete the table below for the value of $y = 2 \sin x + \cos x$.

x°	$2\sin x$	$\cos x$	Y
0°	0	1	1
30°			
45°	1.4	0.7	2.1
60°	1.7	0.5	2.2
90°	2	0	2
120°	1.7	-0.5	1.2
135°	1.4	-0.7	0.7
150°	1	-0.9	0.1
180°	0	-1	-1
225°			
270°	-2	0	-2
315°	-1.4	0.7	-0.7
360°	0	1	-1

(b) Using the grid provided draw the graph of $y = 2 \sin x + \cos x$ for 0° .

Take 1 cm represent 30° on the x- axis and 2 cm to represent 1 unit on the axis.

(c) Use the graph to find the range of x that satisfy the inequalities $2 \sin x \cos x > 0.5$

9. **1999 Q 18 P2**

(a) Complete the table below, giving your values correct to 2 decimal places.

x	0	10	20	30	40	50	60	70
$\tan x$	0							
$2x + 30^\circ$	30	50	70	90	110	130	150	170
$\sin (2x + 30^\circ)$	0.5			1				

b) On the grid provided, draw the graphs of $y = \tan x$ and $y = \sin (2x + 30^\circ)$ for $0^\circ \leq x < 70^\circ$

Take scale: 2 cm for 100 on the x- axis

4 cm for unit on the y- axis

Use your graph to solve the equation $\tan x - \sin (2x + 30^\circ) = 0$

10. **2000 Q 24 P2**

(a) Complete the table for the equation

$$y = 2\sin (3x + 30^\circ) \quad (2\text{marks})$$

x°	$3x + 30^\circ$	$y = 2\sin (3x + 30^\circ)$
0°	30°	1
10°	60°	1.73
20°	90°	2
30°	120°	
40°	150°	
50°	180°	0
60°	210°	
70°	240°	
80°	270°	-2
90°	300°	-1.73

(b) Using the grid provided, draw the graph of $y = 2\sin (3x + 30^\circ)$ for $0^\circ \leq x \leq 90^\circ$.

Take 1cm to represent 40 on the x-axis and 2cm to represent 1 unit on the y axis (3marks)

(c) Use the graph in (b) to find the range of values of x that satisfy the inequality $y \leq 1.6$ (3marks)

11. **2001 Q 21 P2**

a) Complete the table given below in the blank spaces.

x°	$3 \cos 2x$	$2 \sin (2x + 30^\circ)$
0°	3	1
15°	2.598	
30°	1.5	2
45°	0	2.732
60°	1.5	1
75°	-3	
90°	-2.598	0
105°	-1.5	-1
120°	0	-1.732
135°	2.598	-2
150°	3	-2.732
165°		-2
180°		1

b) On the grid provided draw, on the same axis, the graph of $y = 3 \cos 2x$ and $y = \sin(2x + 30^\circ)$ for $0^\circ \leq x \leq 180^\circ$. Take the scale: 1cm for 150° on the axis and 2cm for 1 unit on the y-axis.

c) Use your graph to estimate the range of value of x for which $3 \cos 2x \leq 2 \sin (2x + 30^\circ)$. Give your answer to the nearest degree.

12. **2002 Q 23 P2**

a) Complete the table below, giving your values correct to 2 decimal place.

x°	$\tan \theta^\circ$	$\sin \theta^\circ$
0°	0	0
15°	0.27	0.5
30°	0.58	
45°	1	1
60°	1.73	0.87
75°		0.5
90°	∞	0
105°	3.73	-0.65
120°	1.73	
135°	-1	-1
150°		0.87
165°	0.27	-0.5
180°	0	0

b) Using the grid provided and the table in part
(a) draw the graphs of $Y = \tan \theta$ and $y = \sin 2\theta$.

c) Using your graphs, determine the range of values for which $\tan \theta > \sin 2\theta$ for $0^\circ \leq \theta \leq 90^\circ$.

13.

2003 Q 23 P2

a) Complete the table below, giving your values correct to 2 decimal places.

x°	$\tan \theta^\circ$	$\sin \theta^\circ$
0°	1	0.5
15°	0.77	0.17
30°	0.87	0.87
45°	0.71	0.97
60°	0.15	0.10
75°	0.24	0.97
90°	0	0.87
105°	-0.26	0.71
120°	-0.5	0.5
135°	-0.17	-0.26
150°	0.5	0
165°	0.87	-0.26
180°	1	-0.5

b) Using the grid provided draw, on the same axes, the graph of $y = \cos 2x$ and $y = \sin (x + 30^\circ)$ for $0^\circ < x < 180^\circ$. Take the scale: 1cm for 15° on the x axis 4cm for 1 unit on the y- axis. (4mks)c) Find the periods of the curve $Y = \text{axis}$ (2mks)d) Using the graphs in part (b) above, estimate the solutions to the equation $\sin (x + 30^\circ) = \cos 2x$ (4mks)

14.

2005 Q 21 P2

(a) Complete the table below, giving your values correct to 2 decimal places

x°	0	30	60	90	120	150	180
		0			0	0	0
$2 \sin x^\circ$	0	1		2		1	
$1 - \cos x^\circ$			0.5	1			

(b) On the grid provided, using the same scale and axes, draw the graphs of $y = \sin x^\circ$ and $y = 1 - \cos x^\circ$ $0 \leq x \leq 180^\circ$ Take the scale: 2 cm for 30° on the x- axis 2 cm for 1 unit on the y- axis

(c) Use the graph in (b) above to

(i) Solve equation $2 \sin x^\circ + \cos x^\circ = 1$ (1 mark)(ii) Determine the range of values x for which $2 \sin x^\circ > 1 - \cos x^\circ$ (1 mark)

15. **2007 Q 19 P2**
 (a) Given that $y = 8 \sin 2x - 6 \cos x$, complete the table below for the missing values of y , correct to 1 decimal place.

x°	$y = 8 \sin 2x - 6 \cos x$
0°	-6
15°	-1.8
30°	
45°	3.8
60°	3.9
75°	2.4
90°	0
105°	
120°	-3.9

- (b) On the grid provided, below, draw the graph of $y = 8 \sin 2x - 6 \cos x$ for $0^\circ \leq x \leq 120^\circ$

Take the scale 2 cm for 15° on the x-axis

2 cm for 2 units on the y-axis

(4 marks)

- (c) Use the graph to estimate

(i) The maximum value of y (1 marks)

(ii) The value of x for which $4 \sin 2x - 3 \cos x = 1$

(3 marks)

16. **2008 Q 19 P2**

- a) Complete the table below, giving the values correct to 2 decimal places.

x°	$\sin 2x$	$3 \cos x - 2$
0°	0	1
30°		0.60
60°	0.87	
90°		-2
120°	-0.87	-3.5
150°		
180°	0	
210°	0.87	-4.60
240°	0.87	
270°		
300°		-0.5
330°		
360°	0	1

- b) On the grid provided, draw the graphs of $y = \sin 2x$ and $y = 3 \cos x - 2$ for $0^\circ \leq x \leq 360^\circ$ on the same axes. Use a scale of 1 cm to represent 30° on the x-axis and 2 cm to represent 1 unit on the y-axis.

- c) Use the graph in (b) above to solve the equation $3 \cos x - \sin 2x = 2$.

(2mks)

- d) State the amplitude of $y = 3 \cos x - 2$.

(1mk)

17.

2010 Q 17 P2

(a) Complete the table below, giving the value correct to 2 decimal places.

(2 marks)

x°	$\cos x^\circ$	$\sin(x^\circ + \cos x^\circ)$
0°	1.00	-1.00
20°	0.94	-0.60
40°	0.77	
60°	0.05	0.37
80°		0.81
100°	-0.17	
120°		1.37
140°	0.17	
160°		1.28
180°	-1.00	1.00

b) On the grid provided and using the same axes draw the graphs of $y = \cos x^\circ$ and $y = \sin x^\circ - \cos x^\circ$ for $0^\circ \leq x \leq 180^\circ$. Using the scale; 1 cm for 20° on the x-axis and 4cm for 1 unit on the y-axis. (5 marks)

c) Using the graph in part (b);

i) Solve the equation $\sin x^\circ - \cos x^\circ = 1.2$; (1 mark)

ii) Solve the equation $\cos x^\circ = \frac{1}{2} \sin x^\circ$; (1 mark)

iii) Determine the value of $\cos x^\circ$ in part (c) (ii) above. (1 mark)

18.

2011 Q 16 P2

The table below shows values x and y for the function $y = 2\sin 3x^\circ$ in the range $0^\circ \leq x \leq 150^\circ$

x°	y
0°	1
15°	1.4
30°	2
45°	1.4
60°	0
75°	-1.4
90°	-2
105°	-1.4
120°	0
135°	1.4
150°	2

(a)

On the grid provided, draw the graph of $y = 2\sin 3x$

(2 mks)

(b)

From the graph determine the period. (1 mk)