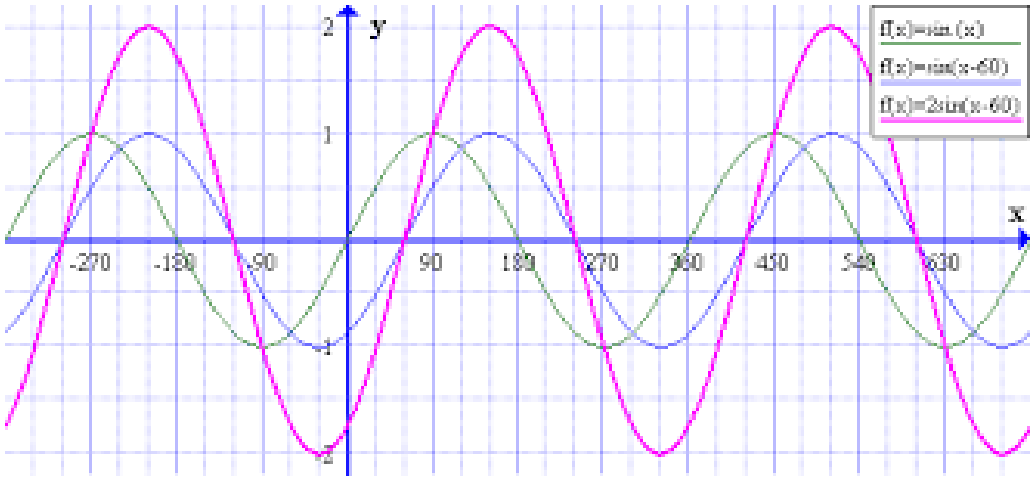
	Wave Function	
1	The expression $3\sin x + 5\cos x$ can be written in the form $R\sin(x + a)^\circ$ where $R > 0$ and $0 \le a \le 360^\circ$. Calculate the values of R and a	4
2	$y = 12\cos x - 5\sin x$ can be expressed in the form $y = k\cos(x - a)^\circ$, where $k > 0$ and $0 \le a \le 360^\circ$ (a) Calculate the values of k and a (b) Hence state the minimum value $y = 12\cos x + 5\sin x$ and determine the value of x for which this minimum occurs in the interval and $0 \le x \le 360^\circ$	 4 3
3	(a) Express $\sin x - 3\cos x$ in the form $k\sin(x - a)$, where $k > 0$ and $0 \le a \le 2\pi$. (b) Find the maximum value of $y = 5 + \sin x - 3\cos x$ and state a value of x for which this maximum occurs	4 3
4	(c) Express $\sin x - \sqrt{3}\cos x$ in the form $k\sin(x - a)^\circ$ where $k > 0$ and $0 \le a \le 360^\circ$. (d) Hence sketch the graph of $y = \sin x - \sqrt{3}\cos x$	4 3
5	(a) Express $5\sin x + 2\cos x$ in the form $k\cos(x - a)$ where $k > 0$ and $0 \le x \le 360^\circ$ (b) Hence or otherwise solve $5\sin x + 2\cos x = 3$ in the interval $0 \le x \le 360^\circ$	4 3

	Wave Function – Answers	
1	Expand the addition formula $R\sin(x + a)$	$R\sin x\cos a + R\cos x\sin a$
	Compare with the original function	$3\sin x + 5\cos x$
	State $R\sin a$ and $R\cos a$	$R\cos a = 3$, $R\sin a = 5$
	Find a value for R and a and state conclusion	$R = \sqrt{34}$, $a = 59^\circ$ $3\sin x + 5\cos x = \sqrt{34}\sin(x + 59)^\circ$
2 (a)	Expand the addition formula $k\cos(x - a)$	$k\cos x\cos a + k\sin x\sin a$
	Compare with the original function	$12\cos x + 5\sin x$
	State $k\sin a$ and $k\cos a$	$k\cos a = 12$, $k\sin a = 5$
	Find a value for k and a and state conclusion	$k = 13$, $a = 22.6^\circ$ $12\cos x - 5\sin x = 13\cos(x - 22.6)^\circ$
(b)	minimum value of $y = \cos x$ is -1 when $x = 180^\circ$ minimum value of $y = 13\cos(x - 22.6)^\circ$ is now **-13** when $x = 180^\circ + 22.6^\circ \rightarrow$ **202.6°**	

3 (a)	Expand the addition formula k*sin*(*x* - *a*) Compare with the original function State ksina and kcosa Find a value for k and a and state conclusion	ksinx cosa - kcosx sina sinx - 3cosx kcosa = 11, -ksina = -3 → ksina = 3 $k = \sqrt{10}$, a = 1.25 sinx - 3cosx = $\sqrt{10}$ sin(x – 1.25)
(b)	Maximum value of *y* = sinx is 1 when $x = \frac{\pi}{2}$ Maximum value of $\sqrt{10}$ sin(x – 1.25) is now 5+ $\sqrt{10}$ when $x = \frac{\pi}{2}$ + 1.25→ 2.82	
4 (a)	Expand the addition formula *k*sin(*x* - a) Compare with the original function State ksina and kcosa Find a value for k and a and state conclusion	ksinx cosa - kcosx sina sinx - √3cosx kcosa = 1, ksina = √3 k = 2, a = 60° sinx - √3cosx = 2sin(x - 60)°
(b)	draw the sine curve with a maximum of 2 and minimum of -2 and a phase shift to the right of 60° - **the pink curve** 	
5 (a)	Expand the addition formula *k*cos(*x* - *a*) Compare with the original function State ksina and kcosa Find a value for k and a and state conclusion	*k*cosx cosa + ksinx sina 2cosx + 5sinx kcosa = 2, ksina = 5 $k = \sqrt{29}$, a = 68.2° 5sinx + 2cosx = $\sqrt{29}$cos(x – 68.2)°
(b)	Set answer from (a) = 3 Solve for two values of *x* Solutions are **x = 12.2° and 124.2°**	$\sqrt{29}$cos(x – 68.2)° = 3 cos(x – 68.2)° = $\frac{3}{\sqrt{29}}$ x – 68.2° = 56° and 304° *x* = 124.2° **and 372.2°** **372.2° - 360° = 12.2°**