⑥ (a) $2\cos x - 3\sin x = k\cos(x+a)$

$= k\cos x\cos a - k\sin x\sin a$

$k\cos a = 2$

$k\sin a = 3$

$k = \sqrt{2^2+3^2}$

$= \sqrt{13}$

$\tan a = \frac{3}{2}$

$a = 56.3^\circ$

S | A
T | C

$\sqrt{13}\cos(x+56.3)^\circ$

(b) $\sqrt{13}\cos(x+56.3)^\circ = 3$

$\cos(x+56.3)^\circ = \frac{3}{\sqrt{13}}$

$x + 56.3 = 33.7^\circ, 326.3^\circ, 393.7^\circ$

S | A
T | C

$x = $ ~~-22.6°~~, $270.0^\circ, 337.4^\circ$

Question			Generic scheme	Illustrative scheme	Max mark
6.	(a)		●¹ use compound angle formula	●¹ $k\cos x°\cos a° - k\sin x°\sin a°$ **stated explicitly**	4
			●² compare coefficients	●² $k\cos a° = 2,\ k\sin a° = 3$ **stated explicitly**	
			●³ process for k	●³ $\sqrt{13}$	
			●⁴ process for a and express in required form	●⁴ $\sqrt{13}\cos(x + 56\cdot3\ldots)°$	

Notes:

1. Accept $k(\cos x°\cos a° - \sin x°\sin a°)$ for ●¹.

   Treat $k\cos x°\cos a° - \sin x°\sin a°$ as bad form only if the equations at the ●² stage both contain k.
2. Do not penalise the omission of degree signs.
3. $\sqrt{13}\cos x°\cos a° - \sqrt{13}\sin x°\sin a°$ or $\sqrt{13}(\cos x°\cos a° - \sin x°\sin a°)$ is acceptable for ●¹ and ●³.
4. ●² is not available for $k\cos x° = 2$, $k\sin x° = 3$, however ●⁴ may still be gained. See Candidate F.
5. Accept $k\cos a° = 2,\ -k\sin a° = -3$ for ●².
6. ●³ is only available for a single value of k, $k > 0$.
7. ●⁴ is not available for a value of a given in radians.
8. Accept values of a which round to 56.
9. Candidates may use any form of the wave function for ●¹, ●² and ●³.

   However, ●⁴ is only available if the wave is interpreted in the form $k\cos(x + a)°$.
10. Evidence for ●⁴ may not appear until part (b).

Commonly Observed Responses:

Candidate A

●¹ ^

$\sqrt{13}\cos a° = 2$

$\sqrt{13}\sin a° = 3$ ●² ✓ ●³ ✓

$\tan a° = \frac{3}{2}$

$a = 56\cdot3$

$\sqrt{13}\cos(x + 56\cdot3)°$ ●⁴ ✓

Candidate B

$k\cos x°\cos a° - k\sin x°\sin a°$ ●¹ ✓

$\cos a° = 2$

$\sin a° = 3$ ●² ✗

$\tan a° = \frac{3}{2}$

$a = 56\cdot3$

Not consistent with equations at ●².

$\sqrt{13}\cos(x + 56\cdot3)°$ ●³ ✓ ●⁴ ✗

Candidate C

$\cos x°\cos a° - \sin x°\sin a°$ ●¹ ✗

$\cos a° = 2$

$\sin a° = 3$ ●² ✓ 2

$k = \sqrt{13}$ ●³ ✓

$\tan a° = \frac{3}{2}$

$a = 56\cdot3$

$\sqrt{13}\cos(x + 56\cdot3)°$ ●⁴ ✗

Question			Generic scheme	Illustrative scheme	Max mark

Candidate D - errors at •2 $k\cos x^\circ \cos a^\circ - k\sin x^\circ \sin a^\circ$ •1 ✓ $k\cos a^\circ = 3$ $k\sin a^\circ = 2$ •2 ✗ $\tan a^\circ = \frac{2}{3}$ $a = 33\cdot7$ $\sqrt{13}\cos(x+33\cdot7)^\circ$ •3 ✓ •4 ✓ 1	**Candidate E** - errors at •2 $k\cos x^\circ \cos a^\circ - k\sin x^\circ \sin a^\circ$ •1 ✓ $k\cos a^\circ = 2$ $k\sin a^\circ = -3$ •2 ✗ $\tan a^\circ = -\frac{3}{2}$ $a = 303\cdot7$ $\sqrt{13}\cos(x+303\cdot7)^\circ$ •3 ✓ •4 ✓ 1	**Candidate F** - use of x $k\cos x^\circ \cos a^\circ - k\sin x^\circ \sin a^\circ$ •1 ✓ $k\cos x^\circ = 2$ $k\sin x^\circ = 3$ •2 ✗ $\tan a^\circ = \frac{3}{2}$ $x = 56\cdot3$ $\sqrt{13}\cos(x+56\cdot3)^\circ$ •3 ✓ •4 ✓ 1
Candidate G $k\cos \mathrm{A}\cos \mathrm{B} - k\sin \mathrm{A}\sin \mathrm{B}$ •1 ✗ $k\cos \mathrm{A}^\circ = 2$ $k\sin \mathrm{A}^\circ = 3$ •2 ✗ Unclear at this stage whether A relates to a or to x. $\tan \mathrm{A}^\circ = \frac{3}{2}$ $a = 56\cdot3$ $\sqrt{13}\cos(x+56\cdot3)^\circ$ •3 ✓ •4 ✓ 1		

	(b)		•5 link to (a) •6 solve for $x+a$ •7 solve for x	•5 $\sqrt{13}\cos(x+56\cdot3\ldots)^\circ = 3$ •6 $33\cdot69\ldots(393\cdot69\ldots)$ (•7) $326\cdot31\ldots$ •7 $337\cdot38\ldots$ 270	3

Notes:

11. Do not penalise working which rounds to 34, 326, 394 leading to 270 and 337.

Commonly Observed Responses: