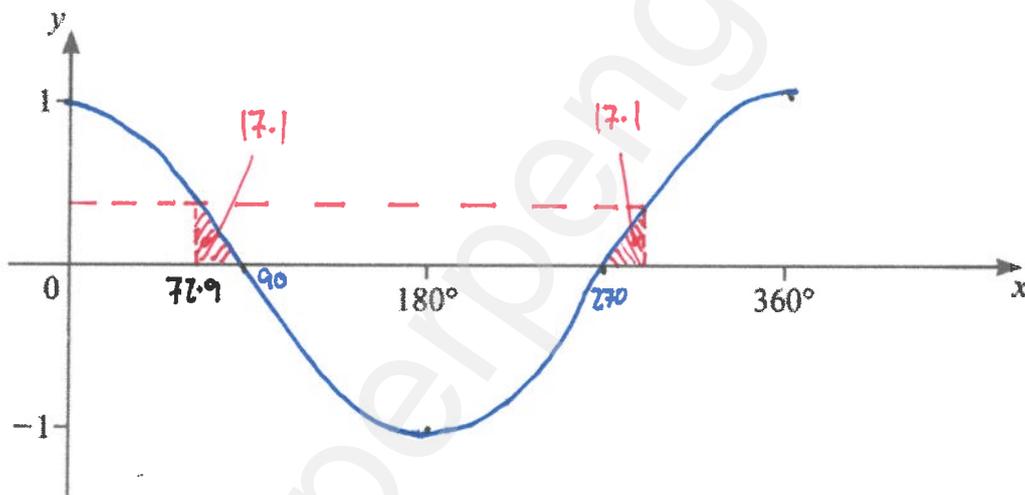The diagram shows the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$.

On the diagram, sketch the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$. [1]

23 (a) On the axes, sketch the graph of $y = \cos x$, for $0° \leqslant x \leqslant 360°$.

[2]

(b) Solve the equation $\cos x = 0.294$ for $0° \leqslant x \leqslant 360°$.

$x = \cos^{-1}(0.294)$

$= 72.9°$ use graph

$270 + 17.1 = 287.1°$

$x = \underline{72.9°}$ or $x = \underline{287.1°}$ [2]

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17 (a) Sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$.

-19.5

19.5

19.5

19.5

[2]
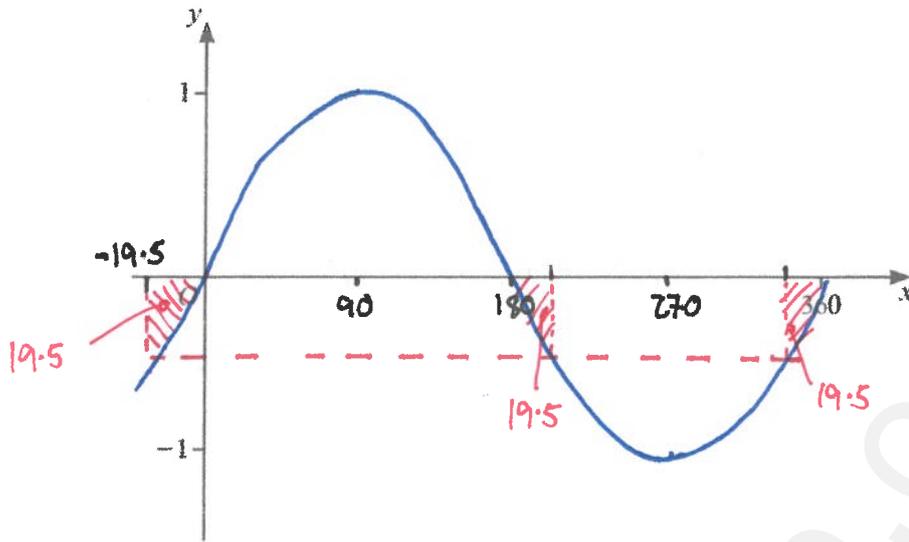
(b) Solve the equation $3 \sin x + 1 = 0$ for $0° \leqslant x \leqslant 360°$.

$3\sin x + 1 = 0$
$\quad -1 \quad -1$
$3\sin x = -1$
$\quad \div 3 \quad \div 3$
$\sin x = \frac{-1}{3}$

$x = \sin^{-1}\left(\frac{-1}{3}\right)$
$\quad = -19.5°$ use graph

$180 + 19.5 = \underline{199.5°}$
$360 - 19.5 = \underline{340.5°}$

$x = \underline{199.5°}$ or $x = \underline{340.5°}$ [3]

19 (a) On the diagram, sketch the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$.

126.9

36.9

36.9

[2]
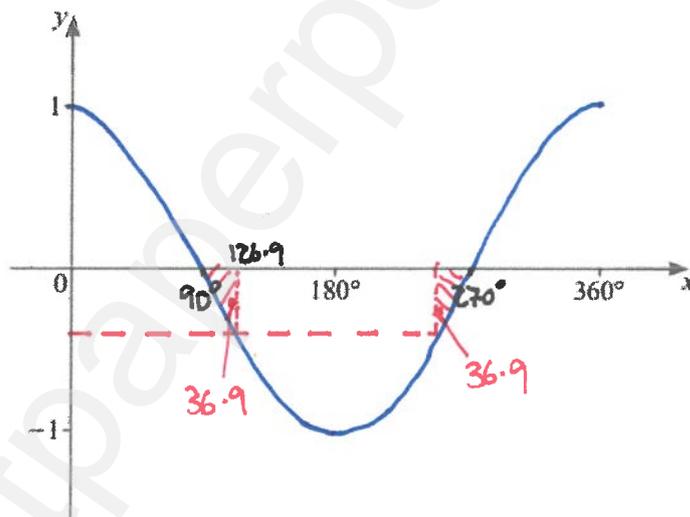
(b) Solve the equation $5 \cos x + 3 = 0$ for $0° \leqslant x \leqslant 360°$.

$5\cos x + 3 = 0$
$\quad -3 \quad -3$
$5\cos x = -3$
$\quad \div 5 \quad \div 5$
$\cos x = \frac{-3}{5}$

$x = \cos^{-1}\left(\frac{-3}{5}\right)$
$\quad = 126.9°$ use graph

$270 - 36.9 = \underline{233.1°}$

$x = \underline{126.9°}$ or $x = \underline{233.1°}$ [3]

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(b) (i) On the grid, sketch the curve $y = \sin x$ for $0° \leqslant x \leqslant 360°$.

-23.6

23.6

23.6

23.6

23.6

[2]
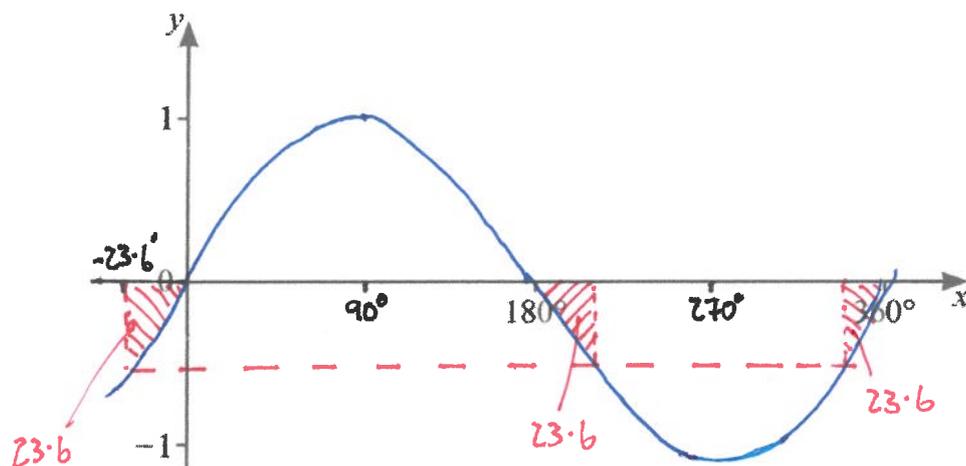
(ii) Solve the equation $\sin x + 0.4 = 0$ for $0° \leqslant x \leqslant 360°$.

$$\sin x + 0.4 = 0$$
$$\quad -0.4 \quad -0.4$$
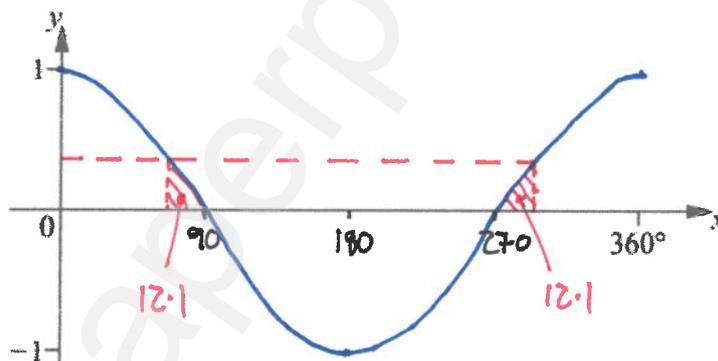$$\sin x = -0.4$$
$$x = \sin^{-1}(-0.4)$$
$$= -23.6° \text{ use graph}$$

$$180 + 23.6 = 203.6°$$
$$360 - 23.6 = 336.4°$$

$x = \underline{203.6°}$ or $x = \underline{336.4°}$ [3]

19 (a)

12.1

12.1

Sketch the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$.

[2]

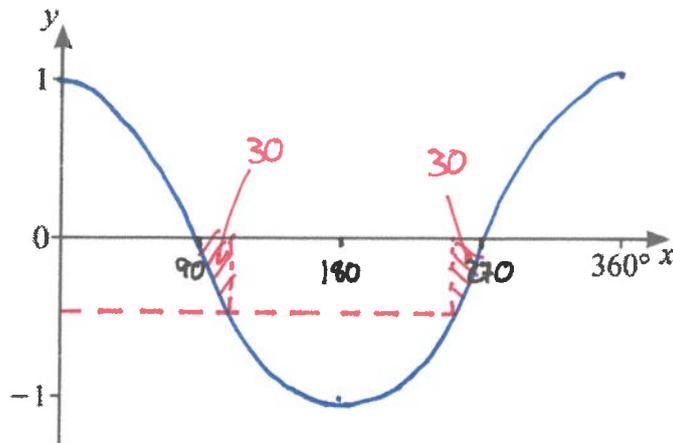**(b)** When $\cos x = 0.21$, find the **reflex** angle x.

$$x = \cos^{-1}(0.21)$$
$$= 77.9° \text{ use graph}$$

$$270 + 12.1 = 282.1°$$

$\underline{282.1°}$ [2]

22

(a) On the diagram, sketch the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$. [2]
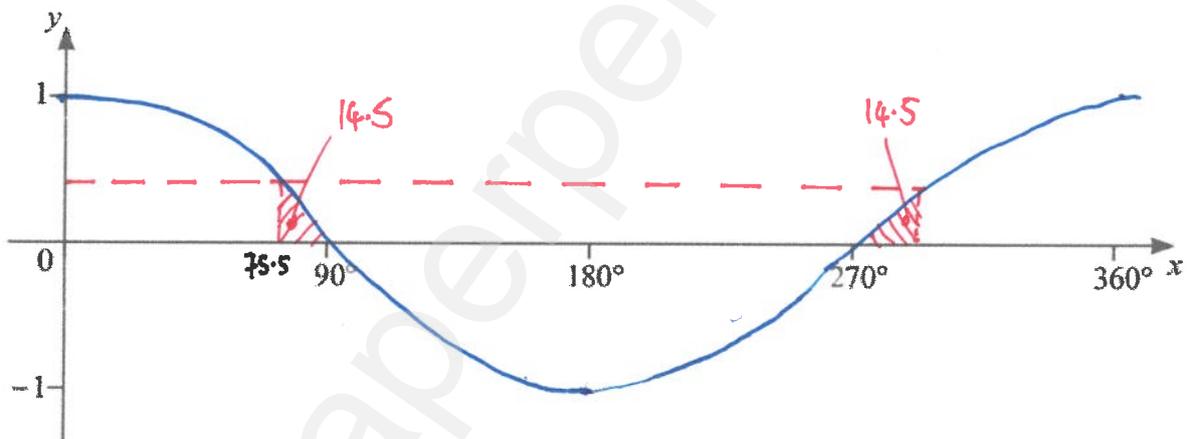
(b) Solve the equation $\cos x = -\frac{1}{2}$ for $0° \leqslant x \leqslant 360°$.

$x = \cos^{-1}\left(\frac{-1}{2}\right)$

$= \underline{120°}$ use graph $\longrightarrow$ $270 - 30 = 240°$

$x = \underline{120°}$ or $x = \underline{240°}$ [2]

19

(a) On the diagram, sketch the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$. [2]

(b) Solve the equation $4\cos x + 2 = 3$ for $0° \leqslant x \leqslant 360°$.

$4\cos x + 2 = 3$
$ -2 -2$
$4\cos x = 1$
$\div 4 \div 4$
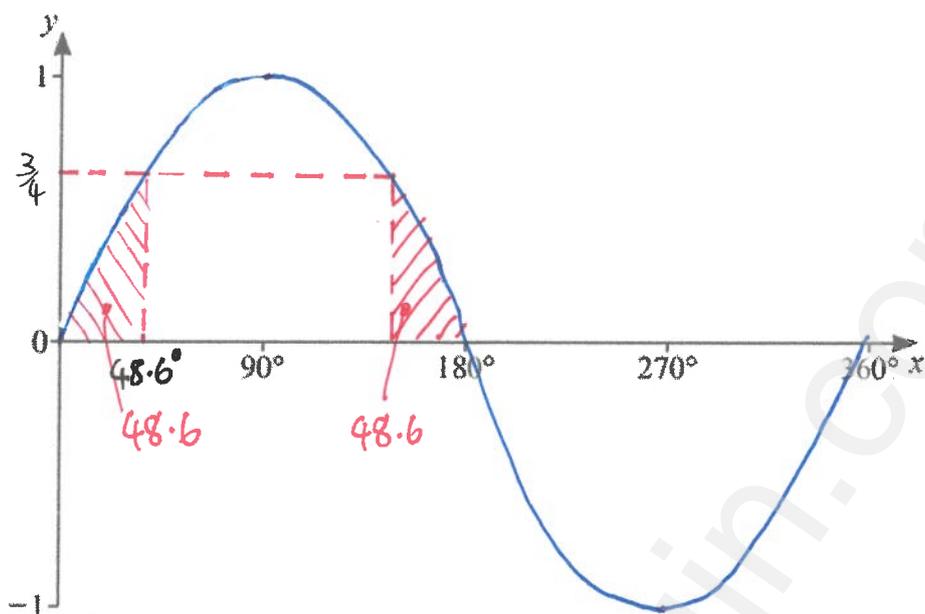$\cos x = \frac{1}{4}$

$x = \cos^{-1}\left(\frac{1}{4}\right)$

$= \underline{75.5°}$ use graph $\longrightarrow$ $270 + 14.5 = 284.5°$

$x = \underline{75.5°}$ and $x = \underline{284.5°}$ [3]

8 **(a)** **(i)** On the axes, sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$.

[2]

(ii) Describe fully the symmetry of the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$.

No reflective symmetry

Rotational symmetry, order 2 [2]

(b) Solve $4\sin x - 1 = 2$ for $0° \leqslant x \leqslant 360°$.

$4\sin x - 1 = 2$
$\qquad +1 \quad +1$
$4\sin x = 3$
$\qquad \div 4 \quad \div 4$
$\sin x = \dfrac{3}{4}$
$x = \sin^{-1}\left(\dfrac{3}{4}\right)$
$= 48.6° \quad$ use graph

$180 - 48.6 = \underline{131.4°}$

$x = \underline{48.6°}$ and $x = \underline{131.4°}$ [3]

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20 **(a)**
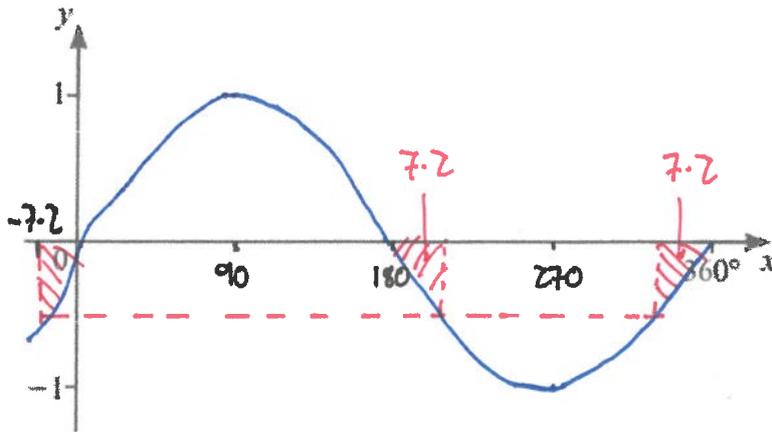
Sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$. [2]

(b) Solve $3 - 2\sin x = \frac{13}{4}$ for $0° \leqslant x \leqslant 360°$.

$$3 - 2\sin x = \frac{13}{4}$$
$$-3 \qquad\qquad -3$$
$$-2\sin x = \frac{1}{4}$$
$$\div -2 \qquad \div -2$$
$$\sin x = \frac{-1}{8}$$
$$x = \sin^{-1}\left(\frac{-1}{8}\right)$$
$$= -7.2° \quad \text{use graph}$$

$$180 + 7.2 = 187.2°$$
$$360 - 7.2 = 352.8°$$

$x = \underline{187.2°}$ or $x = \underline{352.8°}$ [3]

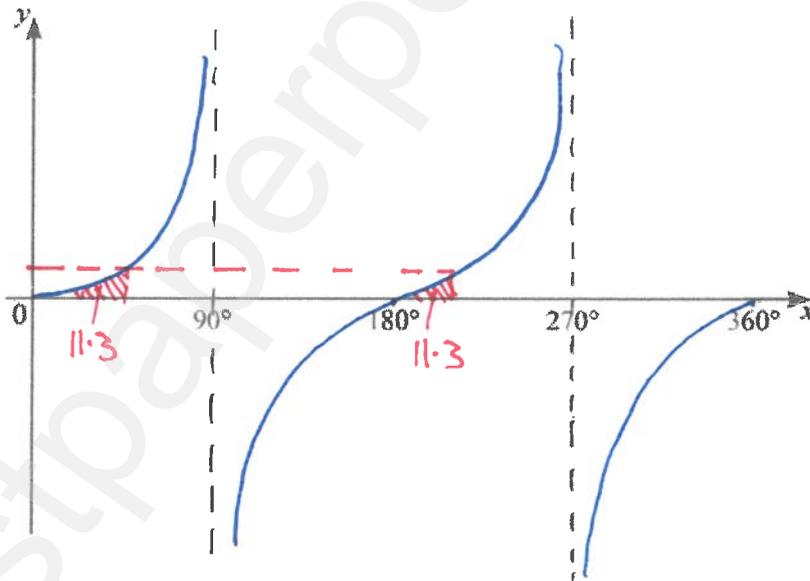**12 (a)** Sketch the graph of $y = \tan x$ for $0° \leqslant x \leqslant 360°$.
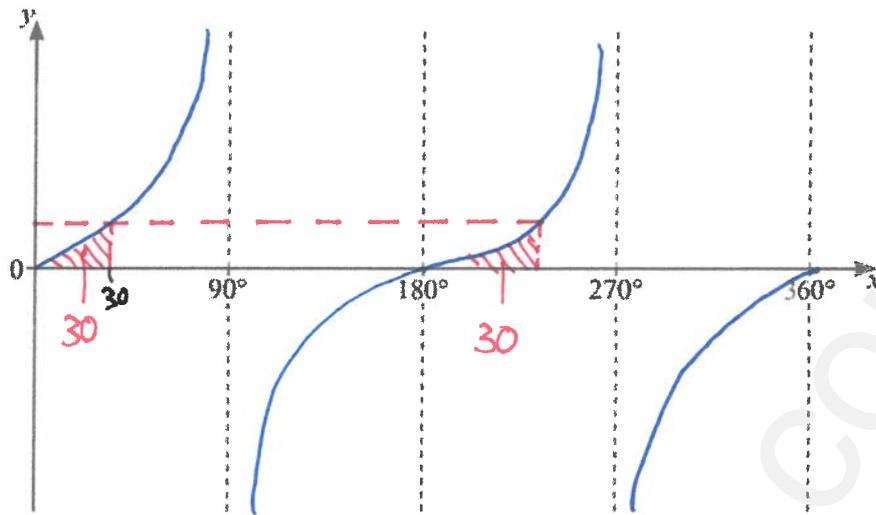
[2]

(b) Find x when $\tan x = \dfrac{1}{\sqrt{3}}$ and $0° \leqslant x \leqslant 360°$.

$$x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$$

$$= \underline{30°} \quad \text{use graph} \quad \rightarrow 180 + 30 = \underline{210°}$$

$$\underline{30° \text{ or } 210°} \quad [2]$$

19 (a) Sketch the graph of $y = \tan x$ for $0° \leqslant x \leqslant 360°$.

[2]

(b) Solve the equation $5\tan x = 1$ for $0° \leqslant x \leqslant 360°$.
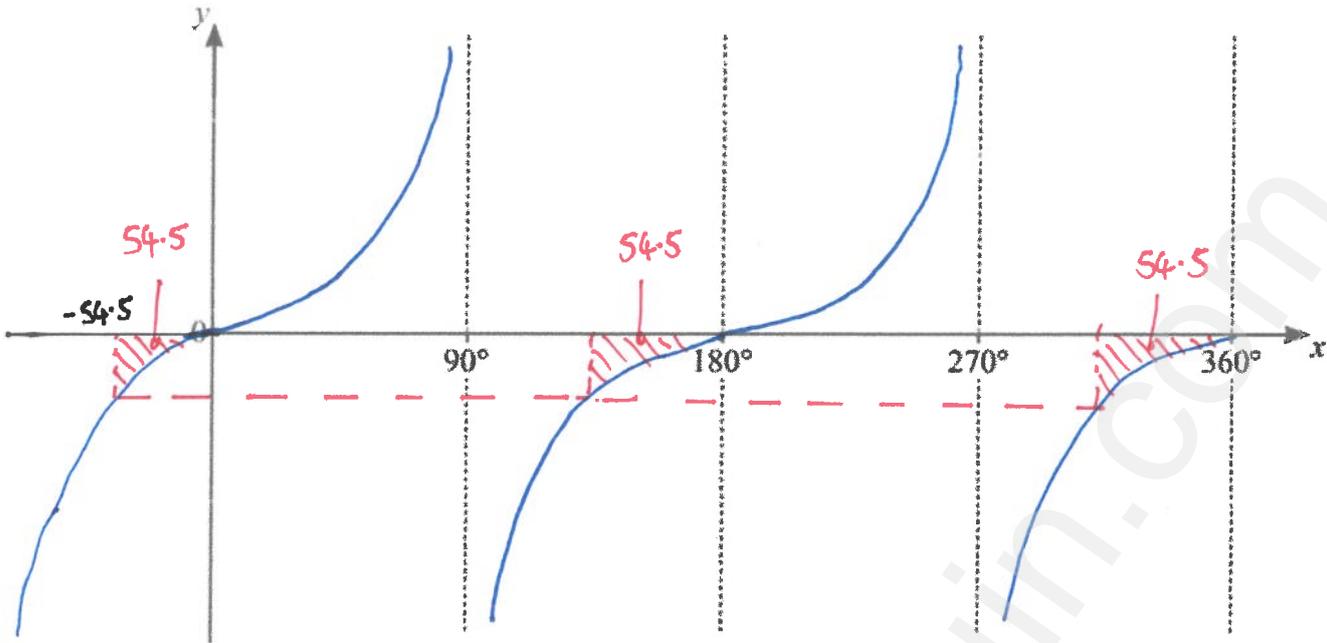
$$5\tan x = 1$$
$$\div 5 \qquad \div 5$$
$$\tan x = \frac{1}{5}$$
$$x = \tan^{-1}\left(\frac{1}{5}\right) \qquad x = \underline{11.3°} \quad \text{use graph: } 180 + 11.3 = \underline{191.3°}$$

$x = \underline{11.3°}$ or $x = \underline{191.3°}$ [2]

(b)

(i) On the diagram, sketch the graph of $y = \tan x$ for $0° \leqslant x \leqslant 360°$. [2]

(ii) Solve the equation $5 \tan x = -7$ for $0° \leqslant x \leqslant 360°$.

$$5 \tan x = -7$$
$$\div 5 \qquad \div 5$$
$$\tan x = \frac{-7}{5}$$
$$x = \tan^{-1}\left(\frac{-7}{5}\right)$$
$$= -54.5° \text{ use graph}$$

$$180 - 54.5 = \underline{125.5°}$$
$$360 - 54.5 = \underline{305.5°}$$

$x = \underline{125.5°}$ or $x = \underline{305.5°}$ [3]

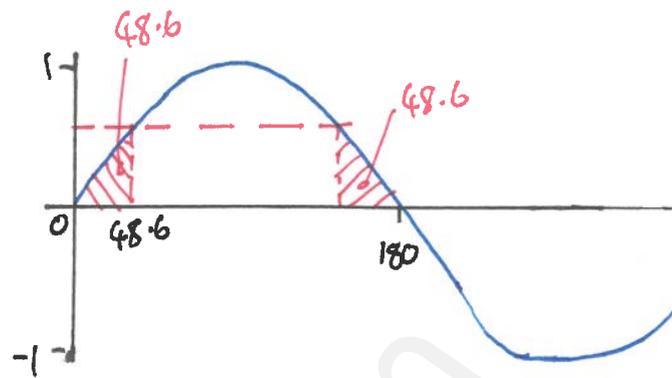**23** Find all the solutions of $4 \sin x = 3$ for $0° \leqslant x \leqslant 360°$.

$4 \sin x = 3$

$\div 4 \qquad \div 4$

$\sin x = \frac{3}{4}$

$x = \sin^{-1}\left(\frac{3}{4}\right)$

$= \underline{48.6°}$ use graph $\rightarrow 180 - 48.6 = \underline{131.4°}$

$\underline{48.6°}$ or $\underline{131.4°}$ [2]

19 Solve the equation $2 + 5 \cos x = 0$ for $0° \leq x \leq 360°$.

$2 + 5 \cos x = 0$

$-2 \qquad\qquad -2$
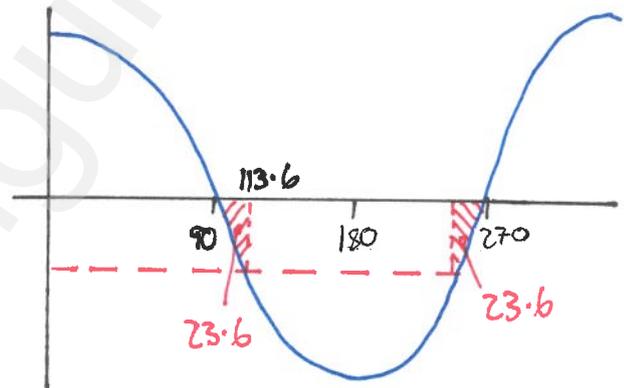
$5 \cos x = -2$

$\div 5 \qquad\qquad \div 5$

$\cos x = \frac{-2}{5}$

$x = \cos^{-1}\left(\frac{-2}{5}\right)$

$= \underline{113.6°}$ use graph $\rightarrow 270 - 23.6 = \underline{246.4°}$

$x = \underline{113.6°}$ or $x = \underline{246.4°}$ [3]

22 Solve the equation $7\sin x + 2 = 0$ for $0° \leqslant x \leqslant 360°$.

$7\sin x + 2 = 0$

$ -2 \quad -2$

$7\sin x = -2$

$ \div 7 \quad \div 7$

$\sin x = \dfrac{-2}{7}$

$x = \sin^{-1}\left(\dfrac{-2}{7}\right)$
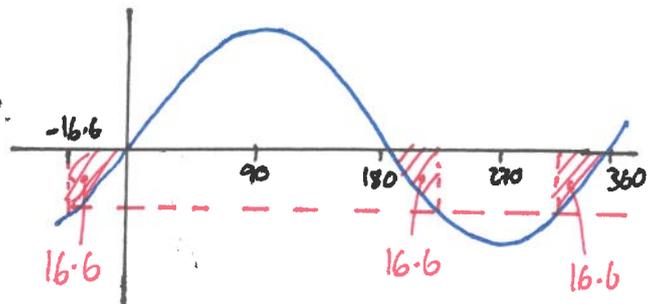
$= -16.6°$ use graph

$180 + 16.6 = 196.6°$

$360 - 16.6 = 343.4°$

$\dots\dots 196.6° \; , \; 343.4° \dots\dots$ [3]

20 Solve $3(2 + \cos x) = 5$ for $0° \leqslant x \leqslant 360°$.

$6 + 3\cos x = 5$

$-6 -6$

$3\cos x = -1$

$ \div 3 \quad \div 3$

$\cos x = \dfrac{-1}{3}$

$x = \cos^{-1}\left(\dfrac{-1}{3}\right)$
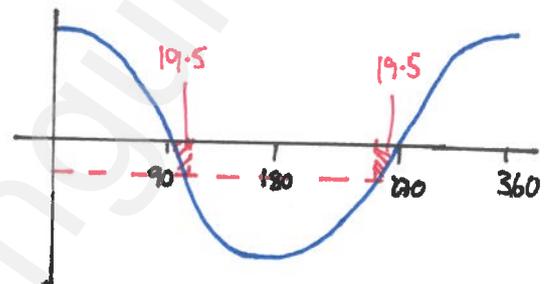
$= \underline{109.5°}$ use graph

$270 - 19.5 = \underline{250.5°}$

$\underline{109.5° \; , \; 250.5°}$ [3]

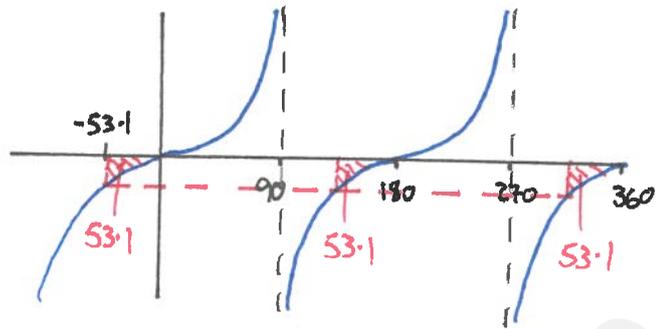**25** Solve $3\tan x = -4$ for $0° \leqslant x \leqslant 360°$.

$$3\tan x = -4$$
$$\div 3 \qquad \div 3$$
$$\tan x = \frac{-4}{3}$$
$$x = \tan^{-1}\left(\frac{-4}{3}\right)$$
$$= -53.1° \quad \text{use graph}$$

$$180 - 53.1 = 126.9°$$
$$360 - 53.1 = 306.9°$$

$x =$ ....176.9°.... or $x =$ ....306.9°.... [3]

-53.1

53.1   53.1   53.1

16 Solve the equation.

$$4(\cos x)^2 = 3 \quad \text{for} \quad 0° \leqslant x \leqslant 360°$$

$$4(\cos x)^2 = 3$$
$$\div 4 \qquad \div 4$$
$$(\cos x)^2 = \frac{3}{4}$$
$$\cos x = \pm\sqrt{\frac{3}{4}}$$

$$\cos x = \frac{\sqrt{3}}{2} \qquad \cos x = \frac{-\sqrt{3}}{2}$$

$$x = \underline{30°} \qquad\qquad x = \underline{150°}$$

use graph: use graph:

$$270 + 60 = \underline{330°} \qquad 270 - 60 = \underline{210°}$$

$x =$ ....30°, 150°, 210°, 330°.... [3]

60   60

60   60
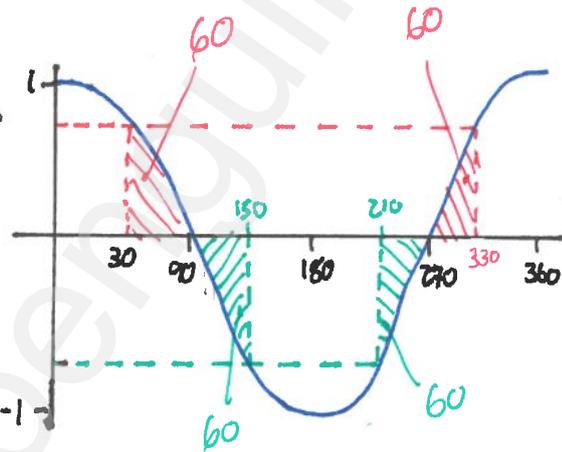
(c) (i) Solve the simultaneous equations.

$$2p + q = 2 \quad ①$$
$$p - q = -\frac{1}{2} \quad ②$$

$① + ②:$ $3p = 1.5$

$\div 3 \qquad \div 3$

$\underline{p = 0.5}$

Sub into $①$: $2(0.5) + q = 2$

$1 + q = 2$

$-1 \qquad -1$

$\underline{q = 1}$

$p = \quad\dots 0.5 \dots$

$q = \quad\dots 1 \dots$ [2]

(ii) Hence, for $0° \leqslant u \leqslant 360°$ and $0° \leqslant v \leqslant 360°$, solve the simultaneous equations.

$$2 \sin u + \cos v = 2$$
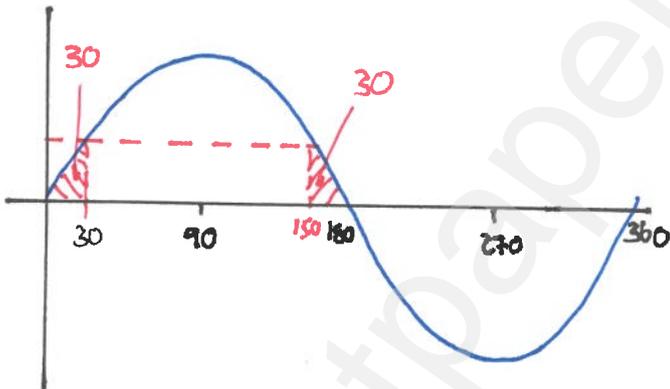$$\sin u - \cos v = -\frac{1}{2}$$

$\sin u = P \qquad \cos v = q$

so: $\sin u = 0.5 \qquad$ so: $\cos v = 1$

$\underline{\sin u = 0.5:}$

$u = \sin^{-1}(0.5)$

$= \underline{30°}$

use graph $\rightarrow$ $180 - 30$

$= \underline{150°}$

$\underline{\cos v = 1:}$

$v = \cos^{-1}(1)$

$= \underline{0°}$

use graph $\rightarrow$ $\underline{360°}$

$u = \underline{30°}$ or $\underline{150°}$

$v = \underline{0°}$ or $\underline{360°}$