c) The sine ratio and the cosine ratio are both negative in quadrant III.

d) The tangent ratio is negative and the cosine ratio is positive in quadrant IV.

Section 2.2 Page 96 Question 5

a) First calculate r.

$r^2 = x^2 + y^2$
$r^2 = (-5)^2 + (12)^2$
$r^2 = 25 + 144$
$r^2 = 169$
$r = 13$

$\sin\theta = \frac{y}{r}$ $\cos\theta = \frac{x}{r}$ $\tan\theta = \frac{y}{x}$

$\sin\theta = \frac{12}{13}$ $\cos\theta = \frac{-5}{13}$ or $-\frac{5}{13}$ $\tan\theta = \frac{12}{-5}$ or $-\frac{12}{5}$

b) $r^2 = x^2 + y^2$
$r^2 = (5)^2 + (-3)^2$
$r^2 = 25 + 9$
$r^2 = 34$
$r = \sqrt{34}$

$\sin\theta = \frac{y}{r}$ $\cos\theta = \frac{x}{r}$ $\tan\theta = \frac{y}{x}$

$\sin\theta = \frac{-3}{\sqrt{34}}$ or $-\frac{3\sqrt{34}}{34}$ $\cos\theta = \frac{5}{\sqrt{34}}$ or $\frac{5\sqrt{34}}{34}$ $\tan\theta = \frac{-3}{5}$ or $-\frac{3}{5}$

c) $r^2 = x^2 + y^2$
$r^2 = (6)^2 + (3)^2$
$r^2 = 36 + 9$
$r^2 = 45$
$r = \sqrt{45}$

$\sin\theta = \frac{y}{r}$ $\cos\theta = \frac{x}{r}$ $\tan\theta = \frac{y}{x}$

$\sin\theta = \frac{3}{\sqrt{45}} = \frac{1}{\sqrt{5}}$ or $\frac{\sqrt{5}}{5}$ $\cos\theta = \frac{6}{\sqrt{45}} = \frac{2}{\sqrt{5}}$ or $\frac{2\sqrt{5}}{5}$ $\tan\theta = \frac{3}{6} = \frac{1}{2}$

d) $r^2 = x^2 + y^2$
$r^2 = (-24)^2 + (-10)^2$
$r^2 = 576 + 100$
$r^2 = 676$
$r = 26$

$\sin\theta = \frac{y}{r}$ $\quad$ $\cos\theta = \frac{x}{r}$ $\quad$ $\tan\theta = \frac{y}{x}$

$\sin\theta = \frac{-10}{26} = -\frac{5}{13}$ $\quad$ $\cos\theta = \frac{-24}{26} = -\frac{12}{13}$ $\quad$ $\tan\theta = \frac{10}{24} = \frac{5}{12}$

Section 2.2 Page 96 Question 6

a) The angle is in quadrant II, so sin 155° is positive.

b) The angle is in quadrant IV, so cos 320° is positive.

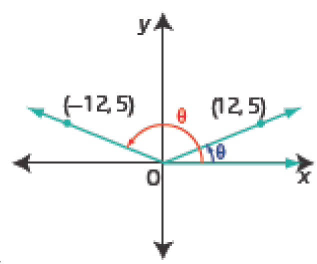
c) The angle is in quadrant II, so tan 120° is negative.

d) The angle is in quadrant III, so cos 220° is negative.

Section 2.2 Page 96 Question 7

a) Given $\sin\theta = \frac{5}{13}$, $y = 5$ and $r = 13$. Use the Pythagorean Theorem to determine x.

$$\begin{aligned} r^2 &= x^2 + y^2 \\ 13^2 &= x^2 + 5^2 \\ 169 &= x^2 + 25 \\ x^2 &= 144 \\ x &= \pm 12 \end{aligned}$$



b) Determine the reference angle.

$$\begin{aligned} \sin\theta &= \frac{5}{13} \\ \theta &= \sin^{-1}\left(\frac{5}{13}\right) \\ \theta &= 22.619... \end{aligned}$$

Then, to the nearest degree, in quadrant I, θ = 23° and in quadrant II, θ = 180° − 23° or 157°.

Section 2.2 Page 96 Question 8

a) $\cos\theta = \frac{x}{r} = -\frac{2}{3}$, so $x = -2$ and $r = 3$ for an angle in quadrant II.

Use the Pythagorean Theorem to determine y.

$$\begin{aligned} r^2 &= x^2 + y^2 \\ 3^2 &= (-2)^2 + y^2 \\ 9 &= 4 + y^2 \\ y &= \sqrt{5} \end{aligned}$$

Then, $\sin\theta = \frac{y}{r}$ and $\tan\theta = \frac{y}{x}$

$\sin\theta = \frac{\sqrt{5}}{3}$ $\qquad$ $\tan\theta = \frac{\sqrt{5}}{-2} = -\frac{\sqrt{5}}{2}$

b) $\sin\theta = \frac{y}{r} = \frac{3}{5}$, so $y = 3$ and $r = 5$ for an angle in quadrant I.

Use the Pythagorean Theorem to determine x.

$r^2 = x^2 + y^2$
$5^2 = x^2 + 3^2$
$25 = x^2 + 9$
$x = 4$

Then, $\cos\theta = \frac{x}{r}$ and $\tan\theta = \frac{y}{x}$

$\cos\theta = \frac{4}{5}$ $\qquad$ $\tan\theta = \frac{3}{4}$

c) $\tan\theta = \frac{y}{x} = -\frac{4}{5}$, so $x = 5$ and $y = -4$ for an angle in quadrant IV.

Use the Pythagorean Theorem to determine r.

$r^2 = x^2 + y^2$
$r^2 = (5)^2 + (-4)^2$
$r^2 = 25 + 16$
$r = \sqrt{41}$

Then, $\sin\theta = \frac{y}{r}$ and $\cos\theta = \frac{x}{r}$

$\sin\theta = \frac{-4}{\sqrt{41}}$ or $-\frac{4\sqrt{41}}{41}$ $\qquad$ $\cos\theta = \frac{5}{\sqrt{41}}$ or $\frac{5\sqrt{41}}{41}$

d) $\sin\theta = \frac{y}{r} = -\frac{1}{3}$, so $y = -1$ and $r = 3$ for an angle in quadrant III.

Use the Pythagorean Theorem to determine x.

$r^2 = x^2 + y^2$
$3^2 = x^2 + (-1)^2$
$9 = x^2 + 1$
$x = -\sqrt{8}$

Then, $\cos\theta = \frac{x}{r}$ and $\tan\theta = \frac{y}{x}$

$\cos\theta = \frac{-\sqrt{8}}{3}$ or $-\frac{2\sqrt{2}}{3}$ $\qquad$ $\tan\theta = \frac{-1}{-\sqrt{8}}$ or $\frac{1}{2\sqrt{2}}$ or $\frac{\sqrt{2}}{4}$

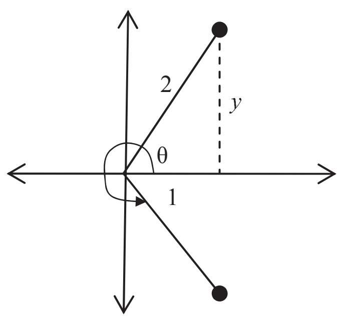
e) $\tan\theta = \frac{y}{x} = \frac{-1}{-1}$, so $x = -1$ and $y = -1$ for an angle in quadrant III.
Use the Pythagorean Theorem to determine r.
$r^2 = x^2 + y^2$
$r^2 = (-1)^2 + (-1)^2$
$r = \sqrt{2}$

Then, $\sin\theta = \frac{y}{r}$ and $\cos\theta = \frac{x}{r}$

$\sin\theta = \frac{-1}{\sqrt{2}}$ or $-\frac{\sqrt{2}}{2}$ $\qquad$ $\cos\theta = \frac{-1}{\sqrt{2}}$ or $-\frac{\sqrt{2}}{2}$

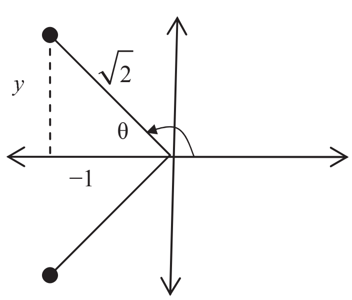
Section 2.2 Page 97 Question 9

a) The diagram shows the two possible positions of θ, $0° \le \theta < 360°$, for which $\cos\theta = \frac{1}{2}$.



$\cos\theta = \frac{1}{2}$ is part of the 30°-60°-90° right triangle with sides 1, 2, and $\sqrt{3}$.
The reference angle for θ is 60°.
In quadrant I, θ = 60°.
In quadrant IV, θ = 360° − 60° or 300°.

b) The diagram shows the two possible positions of θ, $0° \le \theta < 360°$, for which $\cos\theta = -\frac{1}{\sqrt{2}}$.



For $\cos\theta = -\frac{1}{\sqrt{2}}$, refer to the 45°-45°-90° right triangle with sides 1, 1, and $\sqrt{2}$.
The reference angle for θ is 45°.
In quadrant II, θ = 180° − 45° or 135°.
In quadrant III, θ = 180° + 45° or 225°.