Practise

1. Sketch an angle in standard position so that the terminal arm passes through each point.

a) $(2, 6)$ **b)** $(-4, 2)$

c) $(-5, -2)$ **d)** $(-1, 0)$

2. Determine the exact values of the sine, cosine, and tangent ratios for each angle.

a)

b)

c)

d)
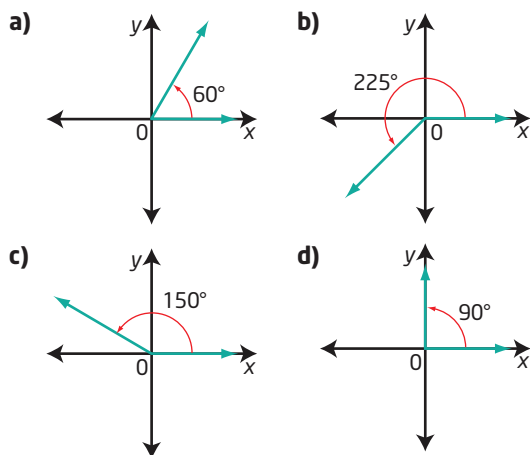
3. The coordinates of a point P on the terminal arm of each angle are shown. Write the exact trigonometric ratios $\sin\theta$, $\cos\theta$, and $\tan\theta$ for each.

a)

b)

c)

d)
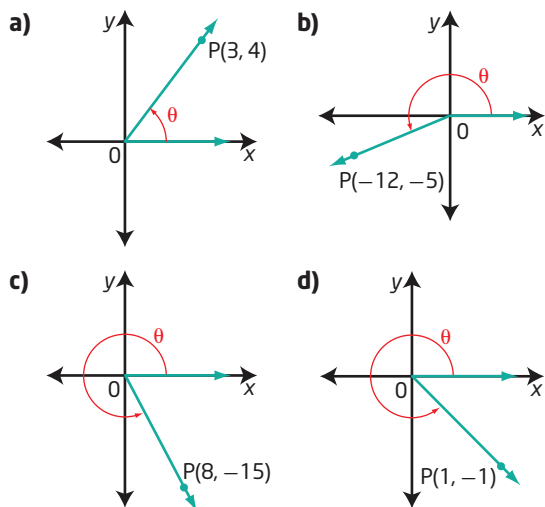
4. For each description, in which quadrant does the terminal arm of angle θ lie?

a) $\cos\theta < 0$ and $\sin\theta > 0$

b) $\cos\theta > 0$ and $\tan\theta > 0$

c) $\sin\theta < 0$ and $\cos\theta < 0$

d) $\tan\theta < 0$ and $\cos\theta > 0$

5. Determine the exact values of $\sin\theta$, $\cos\theta$, and $\tan\theta$ if the terminal arm of an angle in standard position passes through the given point.

a) $P(-5, 12)$

b) $P(5, -3)$

c) $P(6, 3)$

d) $P(-24, -10)$

6. Without using a calculator, state whether each ratio is positive or negative.

a) $\sin 155°$

b) $\cos 320°$

c) $\tan 120°$

d) $\cos 220°$

7. An angle is in standard position such that $\sin\theta = \dfrac{5}{13}$.

a) Sketch a diagram to show the two possible positions of the angle.

b) Determine the possible values of θ, to the nearest degree, if $0° \le \theta < 360°$.

8. An angle in standard position has its terminal arm in the stated quadrant. Determine the exact values for the other two primary trigonometric ratios for each.

	Ratio Value	Quadrant
a)	$\cos\theta = -\dfrac{2}{3}$	II
b)	$\sin\theta = \dfrac{3}{5}$	I
c)	$\tan\theta = -\dfrac{4}{5}$	IV
d)	$\sin\theta = -\dfrac{1}{3}$	III
e)	$\tan\theta = 1$	III

22. $x^2 + y^2 = r^2$

23. a)

θ	20°	40°	60°	80°
sin θ	0.3420	0.6428	0.8660	0.9848
sin (180° − θ)	0.3420	0.6428	0.8660	0.9848
sin (180° + θ)	−0.3420	−0.6428	−0.8660	−0.9848
sin (360° − θ)	−0.3420	−0.6428	−0.8660	−0.9848

b) Each angle in standard position has the same reference angle, but the sine ratio differs in sign based on the quadrant location. The sine ratio is positive in quadrants I and II and negative in quadrants III and IV.

c) The ratios would be the same as those for the reference angle for cos θ and tan θ in quadrant I but may have different signs than sin θ in each of the other quadrants.
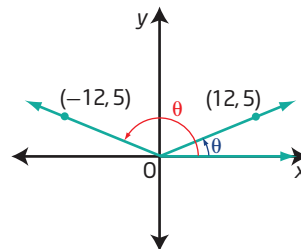
24. a) $\dfrac{3025\sqrt{3}}{16}$ ft

b) As the angle increases to 45° the distance increases and then decreases after 45°.

c) The greatest distance occurs with an angle of 45°. The product of cos θ and sin θ has a maximum value when θ = 45°.

2.2 Trigonometric Ratios of Any Angle, pages 96 to 99

1. a)

b)

c)

d)
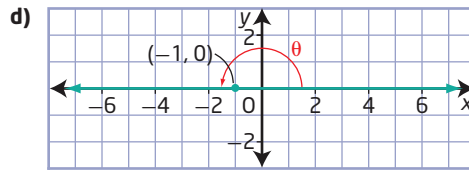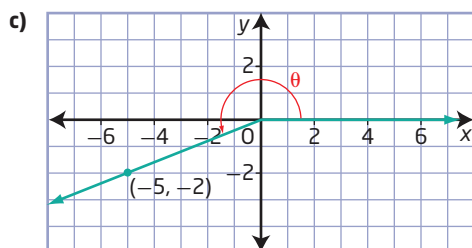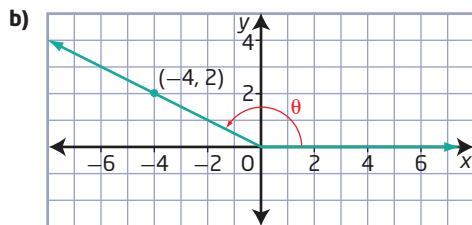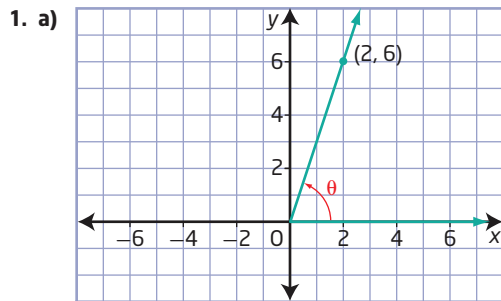
2. a) $\sin 60° = \dfrac{\sqrt{3}}{2}$, $\cos 60° = \dfrac{1}{2}$, $\tan 60° = \sqrt{3}$

b) $\sin 225° = -\dfrac{1}{\sqrt{2}}$ or $-\dfrac{\sqrt{2}}{2}$,
$\cos 225° = -\dfrac{1}{\sqrt{2}}$ or $-\dfrac{\sqrt{2}}{2}$, $\tan 225° = 1$

c) $\sin 150° = \dfrac{1}{2}$, $\cos 150° = -\dfrac{\sqrt{3}}{2}$,
$\tan 150° = -\dfrac{1}{\sqrt{3}}$ or $-\dfrac{\sqrt{3}}{3}$

d) $\sin 90° = 1$, $\cos 90° = 0$, $\tan 90°$ is undefined

3. a) $\sin θ = \dfrac{4}{5}$, $\cos θ = \dfrac{3}{5}$, $\tan θ = \dfrac{4}{3}$

b) $\sin θ = -\dfrac{5}{13}$, $\cos θ = -\dfrac{12}{13}$, $\tan θ = \dfrac{5}{12}$

c) $\sin θ = -\dfrac{15}{17}$, $\cos θ = \dfrac{8}{17}$, $\tan θ = -\dfrac{15}{8}$

d) $\sin θ = -\dfrac{1}{\sqrt{2}}$ or $-\dfrac{\sqrt{2}}{2}$, $\cos θ = \dfrac{1}{\sqrt{2}}$ or $\dfrac{\sqrt{2}}{2}$,
$\tan θ = -1$

4. a) II **b)** I **c)** III **d)** IV

5. a) $\sin θ = \dfrac{12}{13}$, $\cos θ = -\dfrac{5}{13}$, $\tan θ = -\dfrac{12}{5}$

b) $\sin θ = -\dfrac{3}{\sqrt{34}}$ or $-\dfrac{3\sqrt{34}}{34}$,
$\cos θ = \dfrac{5}{\sqrt{34}}$ or $\dfrac{5\sqrt{34}}{34}$, $\tan θ = -\dfrac{3}{5}$

c) $\sin θ = \dfrac{3}{\sqrt{45}}$ or $\dfrac{1}{\sqrt{5}}$, $\cos θ = \dfrac{6}{\sqrt{45}}$ or $\dfrac{2}{\sqrt{5}}$,
$\tan θ = \dfrac{1}{2}$

d) $\sin θ = -\dfrac{5}{13}$, $\cos θ = -\dfrac{12}{13}$, $\tan θ = \dfrac{5}{12}$

6. a) positive **b)** positive
c) negative **d)** negative

7. a)

b) 23° or 157°

8. a) $\sin θ = \dfrac{\sqrt{5}}{3}$, $\tan θ = -\dfrac{\sqrt{5}}{2}$

b) $\cos θ = \dfrac{4}{5}$, $\tan θ = \dfrac{3}{4}$

c) $\sin θ = -\dfrac{4}{\sqrt{41}}$ or $-\dfrac{4\sqrt{41}}{41}$,
$\cos θ = \dfrac{5}{\sqrt{41}}$ or $\dfrac{5\sqrt{41}}{41}$