Practise, Apply, Solve 5.3, page 433

1. **(a)** iii **(b)** i **(c)** iv **(d)** ii

2. **(a)** ii **(b)** iii **(c)** iv **(d)** i

3. **(a)** iii **(b)** iv **(c)** ii **(d)** i

4. **(a)** positive **(b)** positive **(c)** negative
(d) negative **(e)** negative **(f)** negative
(g) negative **(h)** negative

5. **(a)** $\sin\theta = \frac{-4}{5}$, $\cos\theta = \frac{-3}{5}$, $\tan\theta = \frac{4}{3}$

(b) $\sin\theta = \frac{4}{5}$, $\cos\theta = \frac{3}{5}$, $\tan\theta = \frac{4}{3}$

(c) $\sin\theta = \frac{12}{13}$, $\cos\theta = \frac{5}{13}$, $\tan\theta = \frac{12}{5}$

(d) $\sin\theta = \frac{5}{13}$, $\cos\theta = \frac{-12}{13}$, $\tan\theta = \frac{5}{-12}$

(e) $\sin\theta = \frac{-24}{25}$, $\cos\theta = \frac{7}{25}$, $\tan\theta = \frac{-24}{7}$

(f) $\sin\theta = \frac{24}{25}$, $\cos\theta = \frac{-7}{25}$, $\tan\theta = \frac{24}{-7}$

(g) $\sin\theta = -1$, $\cos\theta = 0$, $\tan\theta$ undefined

(h) $\sin\theta = 0$, $\cos\theta = -1$, $\tan\theta = 0$

6. **(a)** 66° **(b)** 347° **(c)** 240° **(d)** 119°

7. **(a)** (7.2 cos 56°, 7.2 sin 56°)
(b) (7.6 cos 113°, 7.6 sin 113°)
(c) (25.1 cos 293°, 25.1 sin 293°)

9. $\sin\theta = \frac{1}{\sqrt{5}} \doteq 0.447$

10. $\cos\alpha = \frac{-5}{\sqrt{61}} \doteq -0.640$

11. 118.07°, 241.93°

12. –298.07°, −241.93°, 61.93°, 118.07°

13. **(a)** Plot the points from the table. Refer to section 5.3 for the graph.

θ	−360°	−270°	−180°	−90°	0°
$f(\theta)$	1	0	−1	0	1

θ	90°	180°	270°	360°
$f(\theta)$	0	−1	0	1

(b) maximum:(−360°, 1), (0°, 1), (360°, 1),
minimum: (−180°, −1), (180°, −1)
(c) (−270°, 0), (−90°, 0), (90°, 0), (270°, 0)
(e) $f(\theta) = \cos\theta$ is symmetric about y-axis

14. **(a)** Plot the points from the table. Refer to section 5.3 for the graph

θ	0°	30°	60°	90°	120°
$f(\theta)$	0	0.6	1.7	—	−1.7

θ	150°	180°	210°	240°
$f(\theta)$	−0.6	0	0.6	1.7

θ	270°	300°	330°	360°
$f(\theta)$	—	−1.7	−0.6	0

(b) (0°, 0), (180°, 0), (360°, 0)
(c) $\tan\theta = \frac{\sin\theta}{\cos\theta}$, function undefined when $\cos\theta = 0$.
$\theta \neq -90° + 180°n$, $n \in \mathbf{I}$
(d) $\theta = 180°n$, $n \in \mathbf{I}$
(f) $f(\theta) = \tan\theta$ is symmetric about the origin

15. 134°, 226°, 494°

16. –17°, 197°, 343°

17. **(a)** $\frac{1}{2}$ **(b)** 3.6, 14.4

18. **(a)** −3.5 **(b)** 1.8, 4.2

19. **(a)** −4.0 m, 1.5 m, −5.0 m **(b)** 1.4 s, 7.2 s
(c) 26.7 s

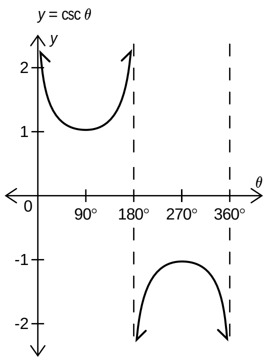
20. Refer to section 5.3 for standard tangent graph; extend graph over given domain; asymptotes: $x = -90°, 90°, 270°, 450°, 630°$; zeros: (0°, 0), (180°, 0), (360°, 0), (540°, 0); −90°, 90°, 270°, 450°, 630°

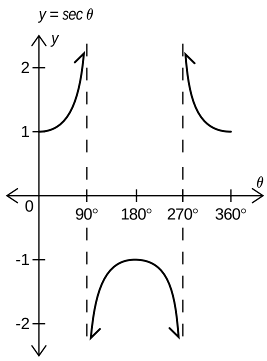
21. **(a)** quadrant I: $\cos\theta$ positive, $\sin\theta$ positive, $\tan\theta$ positive; quadrant II: $\cos\theta$ negative, $\sin\theta$ negative, $\tan\theta$ negative; quadrant III: $\cos\theta$ negative, $\sin\theta$ negative, $\tan\theta$ positive; quadrant IV: $\cos\theta$ positive, $\sin\theta$ negative, $\tan\theta$ negative
(b) quadrant I: all positive; quadrant II: $\sin\theta$ positive; quadrant III: $\tan\theta$ positive; quadrant IV: $\cos\theta$ positive
(c) $y = \cos\theta$: shade under curve between 0° and 90° and between 270° and 360°; $y = \sin\theta$: shade under curve between 0° and 180°; $y = \tan\theta$: shade under curve between 0° and 90° and between 180° and 270°.

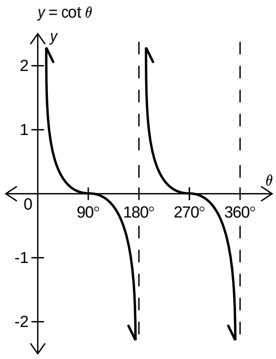
23. **(a)** straight line from (0, 0) to (5, 5) to (15, 5) to (25, −5) to (35, −5) to (40, 0)
(b) 40 cm of string; period is 40 cm; perimeter of cross-section of cube and period of graph are both 40 cm
(c) 80 cm of string to go around cube twice; extend graph in (a) for one more cycle
(d) −5 cm, 25 cm

24. $\theta = -315°, -135°, 45°, 225°$

25. **(a)** $\csc\theta = \frac{1}{\sin\theta}$, $\sec\theta = \frac{1}{\cos\theta}$, $\cot\theta = \frac{1}{\tan\theta}$
(b) $\csc\theta = \frac{r}{y}, y \neq 0$, $\sec\theta = \frac{r}{x}, x \neq 0$, $\cot\theta = \frac{x}{y}, y \neq 0$
(c) $(\theta, \csc\theta)$ = (0°, −), (30°, 2), (60°, 1.2), (90°, 1), (120°, 1.2), (150°, 2), (180°, −), (210°, −2), (240°,−1.2), (270°, −1), (300°, −1.2), (330°, −2), (360°, −)
$(\theta, \sec\theta)$ = (0°, 1), (30°, 1.2), (60°, 2), (90°, −), (120°, −2), (150°, −1.2), (180°, −1), (210°, −1.2), (240°, −2), (270°, −), (300°, 2), (330°, 1.2), (360°, 1)
$(\theta, \cot\theta)$ = (0°, −), (30°, 1.7), (60°, 0.6), (90°, 0), (120°, −0.6), (150°, −1.7), (180°, −), (210°, 1.7), (240°, 0.6), (270°, 0), (300°, −0.6), (330°, −1.7), (360°, −)







(d) The restrictions are shown as vertical asymptotes.
(e) $y = \csc\theta$: D = $\{\theta \mid \theta = m°, m \in \mathbf{R}, \theta \neq 180°n, n \in \mathbf{I}\}$,
R = $\{y \mid y \leq -1 \text{ or } y \geq 1, y \in \mathbf{R}\}$; $y = \sec\theta$:
D = $\{\theta \mid \theta = m°, \theta \neq 90° + 180°n, m \in \mathbf{R}, n \in \mathbf{I}\}$;
R = $\{y \mid y \leq -1 \text{ or } y \geq 1, y \in \mathbf{R}\}$; $y = \cot\theta$:
D = $\{\theta \mid \theta = m°, \theta \neq 180°n, m \in \mathbf{R}, n \in \mathbf{I}\}$; R = $\mathbf{R}$