

Answers

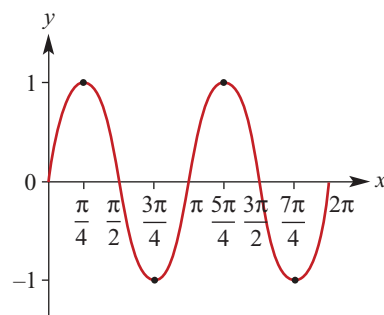
Chapter 1

Exercise 1A

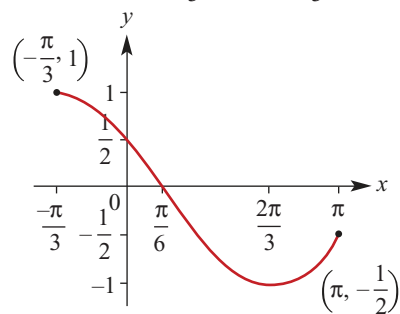
- 1 a i 4π ii 3π iii $-\frac{5\pi}{2}$
 iv $\frac{\pi}{12}$ v $-\frac{\pi}{18}$ vi $-\frac{7\pi}{4}$
 b i 225° ii -120° iii 105°
 iv -330° v 260° vi -165°
 2 a i 0.12° ii -1.75° iii -0.44°
 iv 0.89° v 3.60° vi -7.16°
 b i 97.40° ii -49.85° iii 160.43°
 iv 5.73° v -171.89° vi -509.93°
- 3 a $\frac{\sqrt{3}}{2}$ b $-\frac{\sqrt{2}}{2}$ c $\frac{1}{2}$
 d $-\frac{\sqrt{2}}{2}$ e $\frac{\sqrt{2}}{2}$ f $-\frac{\sqrt{3}}{2}$
 g $-\frac{\sqrt{3}}{2}$ h $-\frac{\sqrt{3}}{2}$ i $\frac{1}{2}$
 4 a $\frac{\sqrt{2}}{2}$ b $\frac{1}{2}$ c $\frac{\sqrt{3}}{2}$
 d $-\frac{1}{2}$ e $\frac{\sqrt{2}}{2}$ f $\frac{\sqrt{3}}{2}$
- 5 a $-\frac{\sqrt{3}}{2}$ b $-\frac{\sqrt{3}}{3}$
 6 a $-\frac{\sqrt{51}}{10}$ b $\frac{\sqrt{51}}{7}$
 7 a $-\frac{\sqrt{3}}{2}$ b $\frac{\sqrt{3}}{3}$
 8 a $\frac{\sqrt{91}}{10}$ b $-\frac{3\sqrt{91}}{91}$
- 9 a $\frac{4\pi}{3}, \frac{5\pi}{3}$ b $\frac{\pi}{6}, \frac{\pi}{3}, \frac{7\pi}{6}, \frac{4\pi}{3}$
 c $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$ d $\frac{5\pi}{6}, \frac{3\pi}{2}$
 e $0, \frac{\pi}{3}, \pi, \frac{4\pi}{3}, 2\pi$ f $\frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{2}, \frac{5\pi}{3}$

- 10 a 1 b $\sqrt{3}$ c $\frac{\sqrt{3}}{3}$ d $\sqrt{3}$
 11 a $\frac{-\sqrt{17}}{17}$ b $\frac{-4\sqrt{17}}{17}$ c $\frac{-1}{4}$ d $\frac{-1}{4}$
 12 a $\frac{\sqrt{21}}{7}$ b $\frac{-2\sqrt{7}}{7}$ c $\frac{\sqrt{3}}{2}$ d $\frac{-\sqrt{3}}{2}$
 13 a $\frac{2\pi}{3}, \frac{5\pi}{3}$
 b $\frac{\pi}{9}, \frac{4\pi}{9}, \frac{7\pi}{9}, \frac{10\pi}{9}, \frac{13\pi}{9}, \frac{16\pi}{9}$
 c $\frac{3\pi}{2}$ d $\frac{\pi}{8}, \frac{5\pi}{8}, \frac{9\pi}{8}, \frac{13\pi}{8}$

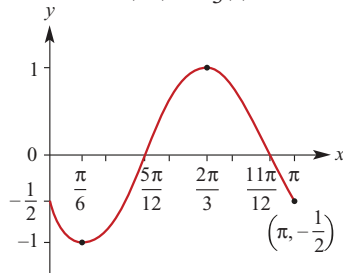
14 a $f(x) = \sin 2x, x \in [0, 2\pi]$



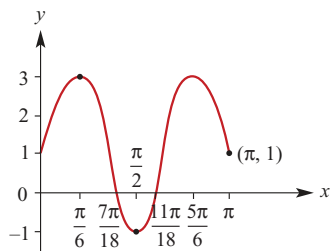
b $f(x) = \cos\left(x + \frac{\pi}{3}\right), x \in \left[-\frac{\pi}{3}, \pi\right]$



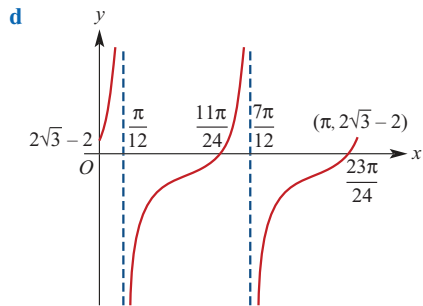
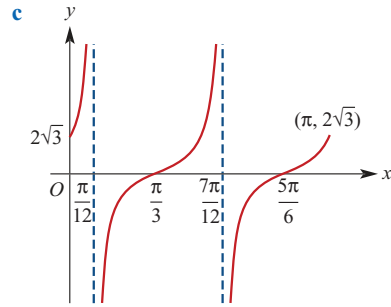
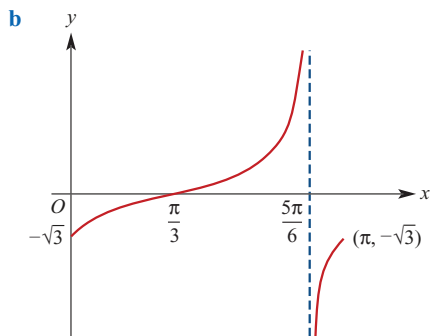
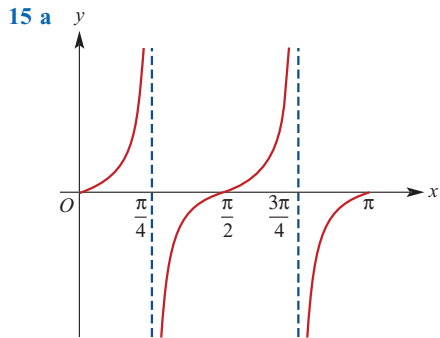
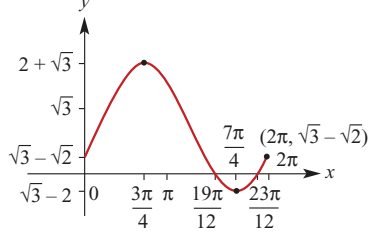
c $f(x) = \cos\left(2\left(x + \frac{\pi}{3}\right)\right), x \in [0, \pi]$



d $f(x) = 2 \sin(3x) + 1, x \in [0, \pi]$



e $f(x) = 2 \sin\left(x - \frac{\pi}{4}\right) + \sqrt{3}, x \in [0, 2\pi]$



Exercise 1B

1 a $\tan x^\circ = \frac{8}{5}, \cos x^\circ = \frac{5\sqrt{89}}{89}, \sin x^\circ = \frac{8\sqrt{89}}{89}$

b $\tan x^\circ = \frac{5\sqrt{6}}{12}, \cos x^\circ = \frac{2\sqrt{6}}{7}, \sin x^\circ = \frac{5}{7}$

c $\tan x^\circ = \frac{4\sqrt{2}}{7}, \cos x^\circ = \frac{7}{9}, \sin x^\circ = \frac{4\sqrt{2}}{9}$

2 a 6 **b** $6\sqrt{2}$ **c** $\frac{20\sqrt{3}}{3}$

3 a $a = \sqrt{26}$

b $a = \sqrt{5}, b = \sqrt{6}, c = \sqrt{7}$ **c** $a = 1$

d $a = 2, b = \sqrt{3}, c = \sqrt{3}, d = \sqrt{6}$

4 a $a = \sqrt{2}, w = \frac{3 - \sqrt{3}}{2}, x = \frac{1 + \sqrt{3}}{2},$

$y = \frac{\sqrt{3} - 1}{2}, z = 15$

b $\sin(15^\circ) = \frac{\sqrt{6} - \sqrt{2}}{4},$

$\cos(15^\circ) = \frac{\sqrt{2} + \sqrt{6}}{4}, \tan(15^\circ) = 2 - \sqrt{3}$

c $\sin(75^\circ) = \frac{\sqrt{2} + \sqrt{6}}{4},$

$\cos(75^\circ) = \frac{\sqrt{6} - \sqrt{2}}{4},$

$\tan(75^\circ) = \frac{1}{2 - \sqrt{3}} = 2 + \sqrt{3}$

Exercise 1C

1 a 11.67 cm

b 9.62 cm

2 a 7.15 cm

b 50.43°

3 16.71 cm

4 a $58.08^\circ, 121.92^\circ$

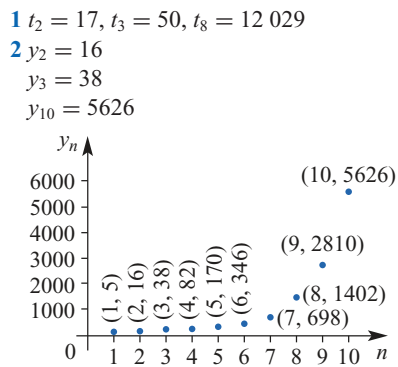
b 10.01 cm, 4.09 cm

- 5 a 6.71 cm
 b 121.33° (acute angle produces inconsistent triangle)
 6 $6\sqrt{6}$ cm 7 $\sqrt{7}$ cm 8 30.10
 9 $5\sqrt{3} \pm \sqrt{39}$ 10 a 54.90 b 100.95

Exercise 1D

- 1 a = 82, x = 30, y = 30, z = 82
 2 a 75° b 62° c 100° d 43°
 3 a = 40, b = 90, c = 50
 4 a 150° b 15°
 5 a = 69, b = 47, c = 75, d = 28, e = 36
 6 a - b + c + 180 7 x = 80, y = 140
 8 a = 60, b = 80, c = 60, d = 40
 9 x = 70, y = 110 10 x = 30, y = 60

Exercise 1E

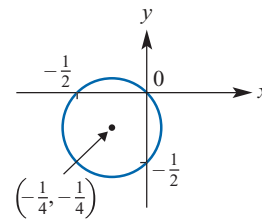


- 3 1, 1, 2, 3, 5, 8, 13, 21, 34, 55
 4 210 5 $\frac{3}{4}$
 6 a 20 b $\frac{4}{5}$ c $\frac{4^{10}}{5^7}$
 7 -9840 8 $a(2 + \sqrt{2})$
 9 a $4 \left[1 - \left(\frac{3}{4}\right)^{10} \right]$
 b i $-2 < x < 2$ ii $\pm 2^{\frac{9}{10}}$
 10 a $\frac{1}{1 - \sin \theta}$
 b $\frac{\pi}{6} + 2k\pi, \frac{5\pi}{6} + 2k\pi, k \in \mathbb{Z}$

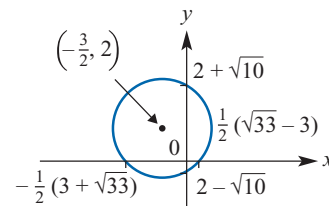
Exercise 1F

- 1 a $(x - 2)^2 + (y - 3)^2 = 1$
 b $(x + 3)^2 + (y - 4)^2 = 25$
 c $x^2 + (y + 5)^2 = 25$
 d $(x - 3)^2 + y^2 = 2$
 2 a centre (-2, 3) radius 1
 b centre (1, 2) radius 2
 c centre $(\frac{3}{2}, 0)$ radius $\frac{3}{2}$
 d centre (-2, 5) radius 2

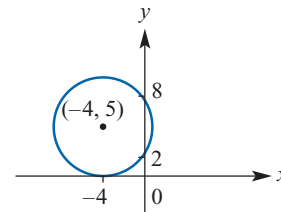
3 a $(x + \frac{1}{4})^2 + (y + \frac{1}{4})^2 = \frac{1}{8}$



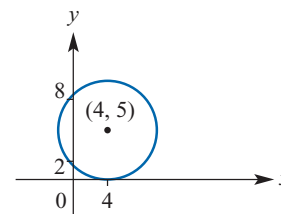
b $(x + \frac{3}{2})^2 + (y - 2)^2 = \frac{49}{4}$



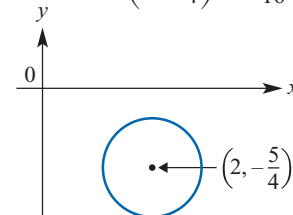
c $(x + 4)^2 + (y - 5)^2 = 25$



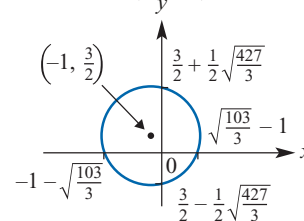
d $(x - 4)^2 + (y - 5)^2 = 25$



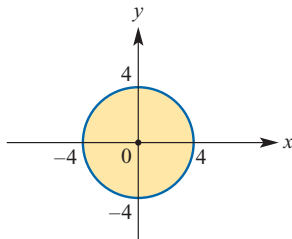
e $(x - 2)^2 + (y + \frac{5}{4})^2 = \frac{9}{16}$



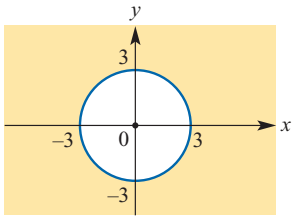
f $(x + 1)^2 + (y - \frac{3}{2})^2 = \frac{439}{12}$



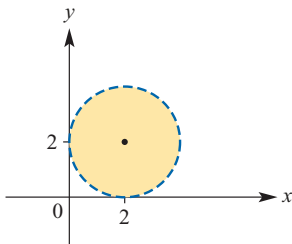
4 a $x^2 + y^2 \leq 16$



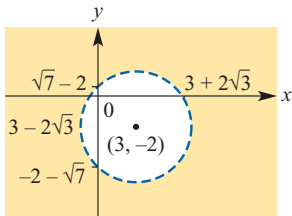
b $x^2 + y^2 \geq 9$



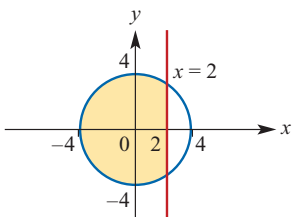
c $(x-2)^2 + (y-2)^2 < 4$



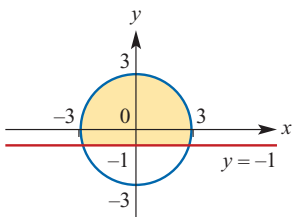
d $(x-3)^2 + (y+2)^2 > 16$



e $x^2 + y^2 \leq 16$ and $x \leq 2$



f $x^2 + y^2 \leq 9$ and $y \geq -1$



5 centre (5, 3), radius $\sqrt{10}$

6 $(x-2)^2 + (y+3)^2 = 9$

7 $(x-5)^2 + (y-4)^2 = 13$

8 $4x^2 + 4y^2 - 60x - 76y + 536 = 0$ has centre

$(\frac{15}{2}, \frac{19}{2})$ and radius $\frac{5\sqrt{2}}{2}$

$x^2 + y^2 - 10x - 14y + 49 = 0$ has centre

(5, 7) and radius 5

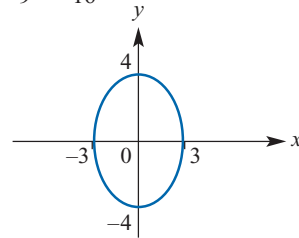
Points of intersection are (5, 12) and (10, 7)

9 a $(\frac{5\sqrt{2}}{2}, \frac{5\sqrt{2}}{2}), (\frac{-5\sqrt{2}}{2}, \frac{-5\sqrt{2}}{2})$

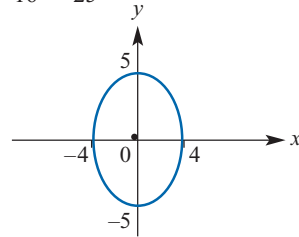
b $(\sqrt{5}, 2\sqrt{5}), (-\sqrt{5}, -2\sqrt{5})$

Exercise 1G

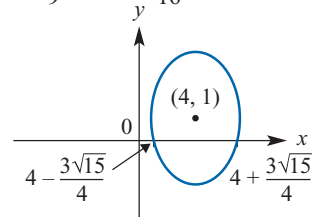
1 a $\frac{x^2}{9} + \frac{y^2}{16} = 1$, centre (0, 0)



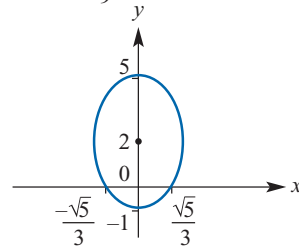
b $\frac{x^2}{16} + \frac{y^2}{25} = 1$, centre (0, 0)



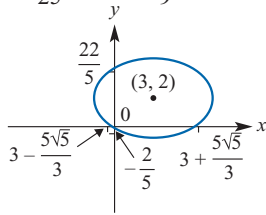
c $\frac{(x-4)^2}{9} + \frac{(y-1)^2}{16} = 1$, centre (4, 1)



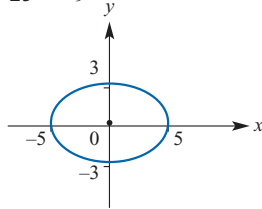
d $x^2 + \frac{(y-2)^2}{9} = 1$, centre (0, 2)



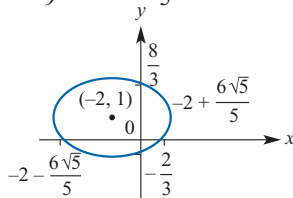
e $\frac{(x-3)^2}{25} + \frac{(y-2)^2}{9} = 1$, centre (3, 2)



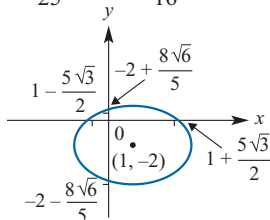
f $\frac{x^2}{25} + \frac{y^2}{9} = 1$, centre (0, 0)



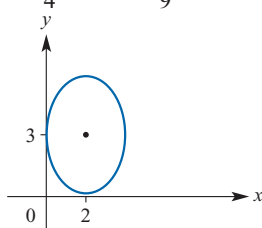
g $\frac{(x+2)^2}{9} + \frac{(y-1)^2}{5} = 1$, centre (-2, 1)



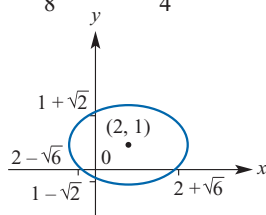
h $\frac{(x-1)^2}{25} + \frac{(y+2)^2}{16} = 1$, centre (1, -2)



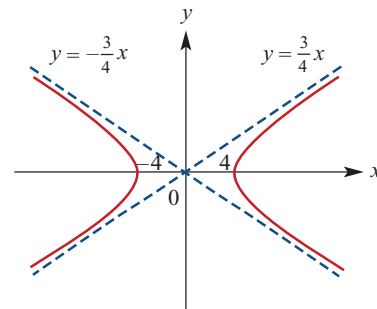
i $\frac{(x-2)^2}{4} + \frac{(y-3)^2}{9} = 1$, centre (2, 3)



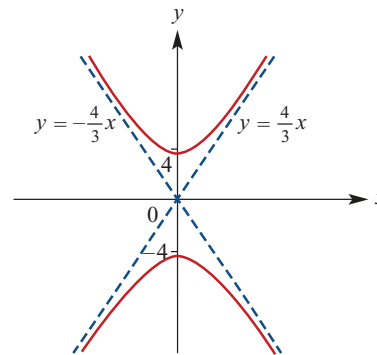
j $\frac{(x-2)^2}{8} + \frac{(y-1)^2}{4} = 1$, centre (2, 1)



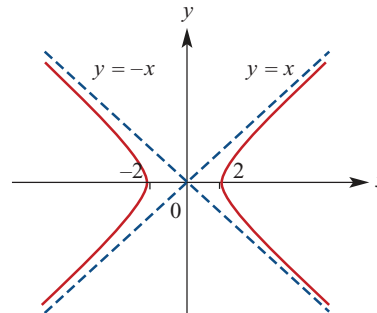
2 a $\frac{x^2}{16} - \frac{y^2}{9} = 1$, asymptotes $y = \pm \frac{3}{4}x$



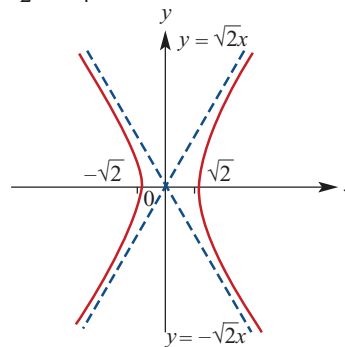
b $\frac{y^2}{16} - \frac{x^2}{9} = 1$, asymptotes $y = \pm \frac{4}{3}x$



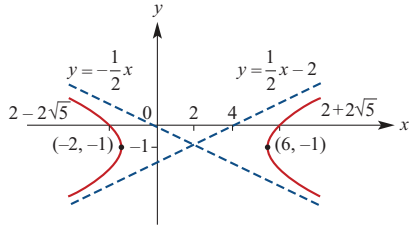
c $\frac{x^2}{4} - \frac{y^2}{4} = 1$, asymptotes $y = \pm x$



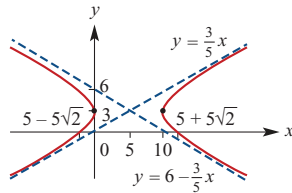
d $\frac{x^2}{2} - \frac{y^2}{4} = 1$, asymptotes $y = \pm \sqrt{2}x$



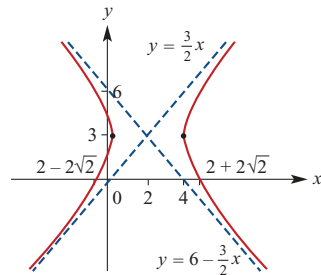
e $\frac{(x-2)^2}{16} - \frac{(y+1)^2}{4} = 1$, asymptotes
 $y = \frac{1}{2}x - 2$ $y = -\frac{1}{2}x$



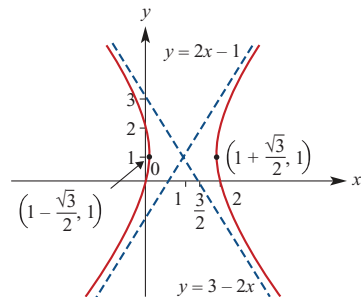
f $\frac{(x-5)^2}{25} - \frac{(y-3)^2}{9} = 1$, asymptotes
 $y = \frac{3}{5}x$ $y = 6 - \frac{3}{5}x$



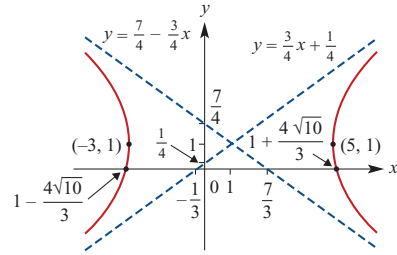
g $\frac{(x-2)^2}{4} - \frac{(y-3)^2}{9} = 1$, asymptotes
 $y = \frac{3}{2}x$ $y = 6 - \frac{3}{2}x$



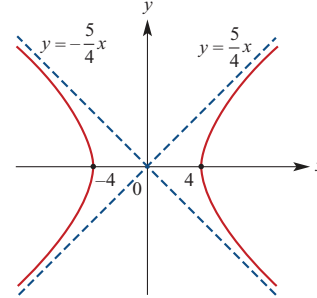
h $\frac{4(x-1)^2}{3} - \frac{(y-1)^2}{3} = 1$, asymptotes
 $y = 2x - 1$ $y = 3 - 2x$



i $\frac{(x-1)^2}{16} - \frac{(y-1)^2}{9} = 1$, asymptotes
 $y = \frac{3}{4}x + \frac{1}{4}$ $y = \frac{7}{4} - \frac{3}{4}x$



j $\frac{x^2}{16} - \frac{y^2}{25} = 1$, asymptotes
 $y = \pm \frac{5}{4}x$



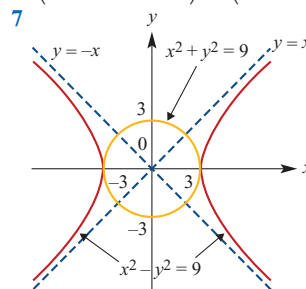
3 a $\left(\frac{2\sqrt{3}}{3}, \frac{\sqrt{3}}{3}\right), \left(\frac{-2\sqrt{3}}{3}, \frac{-\sqrt{3}}{3}\right)$

b $\left(\sqrt{2}, \frac{\sqrt{2}}{2}\right), \left(-\sqrt{2}, \frac{-\sqrt{2}}{2}\right)$

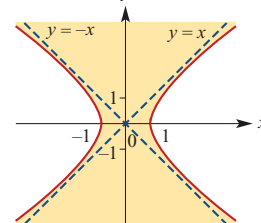
5 $\left(\frac{-6\sqrt{13}}{13}, \frac{-6\sqrt{13}}{13}\right), \left(\frac{6\sqrt{13}}{13}, \frac{6\sqrt{13}}{13}\right),$

$\left(\frac{-6\sqrt{13}}{13}, \frac{6\sqrt{13}}{13}\right), \left(\frac{6\sqrt{13}}{13}, \frac{-6\sqrt{13}}{13}\right)$

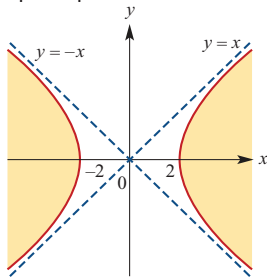
6 $\left(-2\sqrt{2}, \frac{-5\sqrt{2}}{2}\right), \left(2\sqrt{2}, \frac{5\sqrt{2}}{2}\right)$



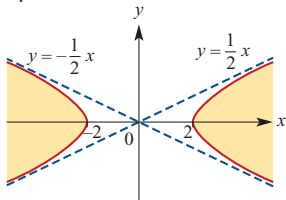
8 a $x^2 - y^2 \leq 1$



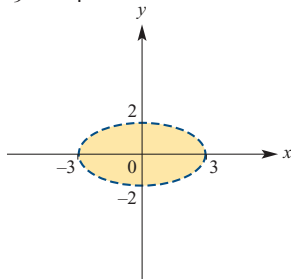
b $\frac{x^2}{4} - \frac{y^2}{4} \geq 1$



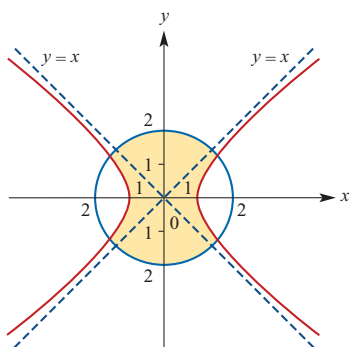
c $\frac{x^2}{4} - y^2 \geq 1$



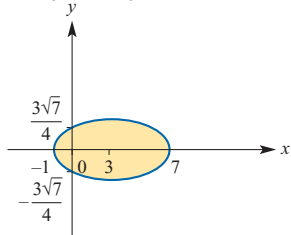
d $\frac{x^2}{9} + \frac{y^2}{4} < 1$



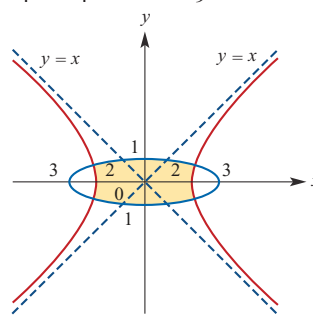
e $x^2 - y^2 \leq 1$ and $x^2 + y^2 \leq 4$



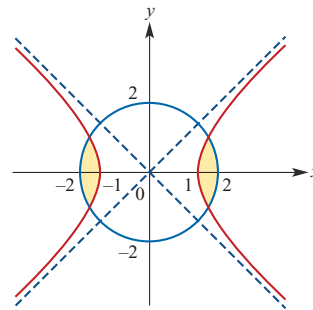
f $\frac{(x-3)^2}{16} + \frac{y^2}{9} \leq 1$



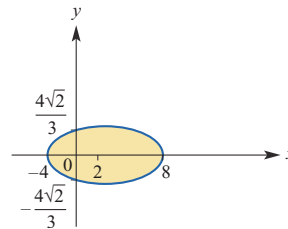
g $\frac{x^2}{4} - \frac{y^2}{4} \leq 1$ and $\frac{x^2}{9} + y^2 \leq 1$



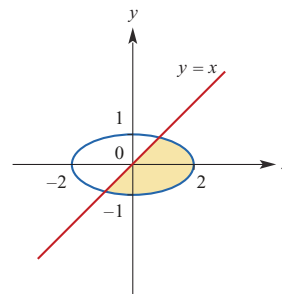
h $x^2 - y^2 > 1$ and $x^2 + y^2 = 4$



i $\frac{(x-2)^2}{36} + \frac{y^2}{4} \leq 1$



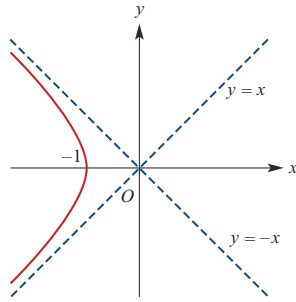
j $\frac{x^2}{4} + y^2 \leq 1$ and $y \leq x$



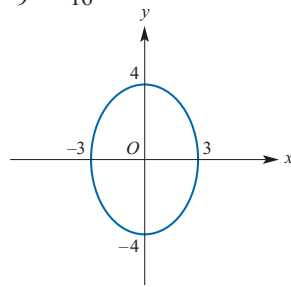
Exercise 1H

1 $x^2 + y^2 = 4$ dom = $[-2, 2]$ ran = $[-2, 2]$

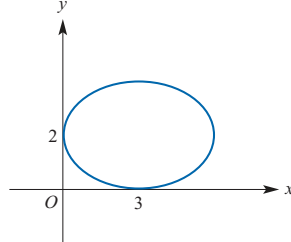
2 a $x^2 - y^2 = 1 \quad x \in (-\infty, -1]$



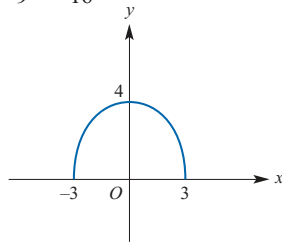
b $\frac{x^2}{9} + \frac{y^2}{16} = 1$



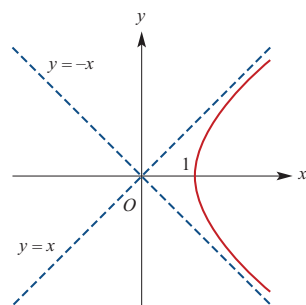
c $\frac{(x-3)^2}{9} + \frac{(y-2)^2}{4} = 1$



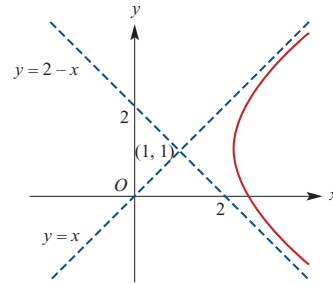
d $\frac{x^2}{9} + \frac{y^2}{16} = 1 \quad x \in [-3, 3] \quad y \in [0, 4]$



e $x^2 - y^2 = 1 \quad x \in [1, \infty)$



f $(x-1)^2 - (y-1)^2 = 1 \quad x \in [2, \infty)$



3 a $x = 4 \cos t \quad y = 4 \sin t$

b $x = 3 \sec t \quad y = 2 \tan t$

c $x = 3 \cos t + 1 \quad y = 3 \sin t - 2$

d $x = 9 \cos t + 1 \quad y = 6 \sin t - 3$

4 a = 1, b = 2, c = 3, d = 2

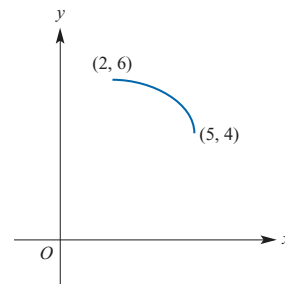
5 $x = 4 \cos t, y = 3 \sin t$

6 a $x = 2 \cos t, y = 6 \sin t$ b $\frac{x^2}{4} + \frac{y^2}{36} = 1$

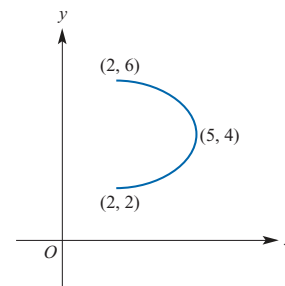
7 a $x = -2 \cos \frac{t}{2}, y = 2 + 3 \sin \frac{t}{2}$

b $\frac{x^2}{4} + \frac{(y-2)^2}{9} = 1$

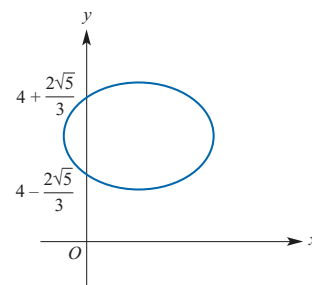
8 a Dom = [2, 5] Ran = [4, 6]



b Dom = [2, 5] Ran = [2, 6]



c Dom = [-1, 5] Ran = [2, 6]

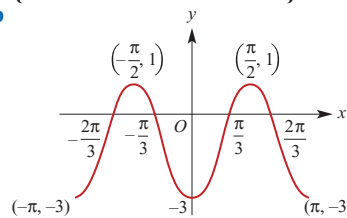


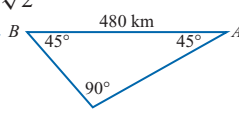
Multiple-choice questions

- 1 B 2 D 3 C 4 A 5 C
6 C 7 B 8 C 9 D 10 D

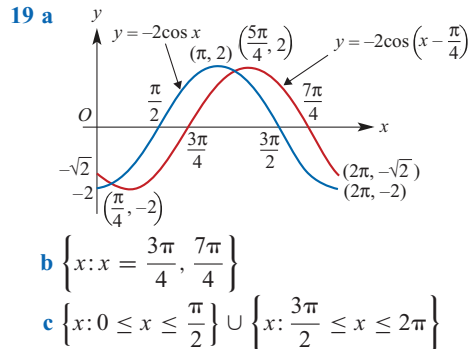
Short-answer questions (technology-free)

- 1 $f_n = 5^n$ 2 $\frac{10}{\cos \alpha}$ cm
3 $\frac{(x+2)^2}{4} + \frac{(y-3)^2}{16} = 1$
4 $\frac{7}{\sqrt{113}}$ 5 $\frac{9}{2}$
6 a $\sqrt{34}$ cm b $2 \tan^{-1} \left(\frac{5}{3}\right)$
7 a $\frac{\sqrt{2}}{2}$ b $-\frac{4}{5}$ c 210° is one possible answer
8 a x b $\sqrt{a(a+b)}$
9 $\tan^{-1}(3\sqrt{2})$
10 a $\left\{x: x = -\frac{2\pi}{3}, -\frac{\pi}{3}, \frac{\pi}{3}, \frac{2\pi}{3}\right\}$
b



- c $\left[-\pi, -\frac{2\pi}{3}\right) \cup \left(-\frac{\pi}{3}, \frac{\pi}{3}\right) \cup \left(\frac{2\pi}{3}, \pi\right]$
11 a 90° b 45° and $\tan^{-1} \left(\frac{3}{4}\right)$
c $\tan^{-1} \left(\frac{5}{4}\right)$
12 a $3\sqrt{97}$ nautical miles b $5\sqrt{97}$ nautical miles
13 $9\sqrt{2}$
14 a  b $240\sqrt{2}$ km
c $480\sqrt{2}$ km

- 15 $y = 3x + 2, y = -3x + 2$
16 $\frac{(x-4)^2}{9} + (y+6)^2 = 1$
17 a 60 b $a = 30, b = 30, c = 120, d = 60$
18 $x^2 + (y-4)^2 = 4$



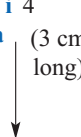
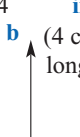
- 20 a $\frac{\pi}{6}, \frac{5\pi}{6}$ b $\frac{\pi}{6}, \frac{11\pi}{6}$ c $\frac{\pi}{4}, \frac{5\pi}{4}$
21 $a = 1, c = 2, b = d = 3$
22 a 50° b 50° c 40°
23 Centre $(-4, 6)$, radius 7
24 $(\pm 9, 0)$ $(0, \pm 3)$
25 a i $n = 7p + 7$
ii $5n = 70p^2 + 147p + 77$
26 a $t_n = 3^{n-1}$ b 3^{190}

Extended-response questions

- 1 a 10.2 km b 049°
c i 11.08 km ii 031°
d 11.93 km
2 a i $[-\sqrt{2}, \sqrt{2}]$ ii $[-3 - \sqrt{5}, -3 + \sqrt{5}]$ iii $(0, -3)$
b 2, 3, 1, 2 c $\left(\frac{37}{13}, \frac{11}{13}\right)$ d $\left(0, \frac{48}{13}\right)$
e $\left(x - \frac{1}{2}\right)^2 + \left(y - \frac{35}{26}\right)^2 = \frac{3890}{676}$
3 e $\frac{3}{4}$, undefined
f $y = 4$ and $y = -\frac{4}{3}x + \frac{20}{3}$
4 a $y = (\tan \theta)x$
b $(-a \cos \theta, -a \sin \theta)$
c $y - a \sin \theta = -\frac{\cos \theta}{\sin \theta}(x - a \cos \theta)$
d A $\left(\frac{a}{\cos \theta}, 0\right)$; B $\left(0, \frac{a}{\sin \theta}\right)$
e Area = $\frac{a^2}{2 \sin \theta \cos \theta} = \frac{a^2}{\sin 2\theta}$
Minimum when $\theta = \frac{\pi}{4}$
5 a $y = -\frac{\sqrt{3}}{3}x + \frac{2\sqrt{3}a}{3}$; $y = \frac{\sqrt{3}}{3}x - \frac{2\sqrt{3}a}{3}$
b $x^2 + y^2 = 4a^2$
6 a $100^\circ, 15^\circ, 65^\circ$ b 2.63 km, 4.56 km
c 346° d 14.18 km

Chapter 2

Exercise 2A

- 1 a i 2b ii 4a iii $2a + \frac{3}{2}b$
iv $\frac{1}{2}b - 2a$ v $2a - \frac{3}{2}b$
b i 4 ii 4 iii $\sqrt{13}$
2 a  (3 cm long) b  (4 cm long)
3 a 6 b $\frac{9}{2}$ c $\frac{3}{2}$