

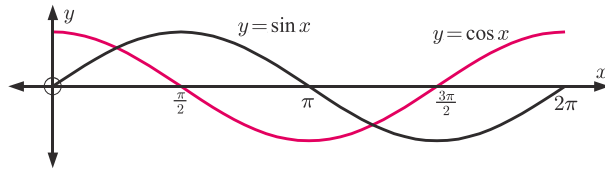
7 $\theta = \frac{\pi}{3}, \frac{4\pi}{3}$

a $x = \frac{\pi}{2}, \frac{3\pi}{2}$ b $x = \frac{\pi}{12}, \frac{\pi}{3}, \frac{7\pi}{12}, \frac{5\pi}{6}, \frac{13\pi}{12}, \frac{4\pi}{3}, \frac{19\pi}{12}, \frac{11\pi}{6}$

c $x = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$

8 a $x = 0^\circ, 90^\circ, 180^\circ$ b $x = \frac{\pi}{4}, \frac{5\pi}{4}, \frac{9\pi}{4}$

9 a



b $x = \frac{\pi}{4}$ or $\frac{5\pi}{4}$

10 a $x = \frac{3\pi}{4}$ or $\frac{7\pi}{4}$ b $x = \frac{\pi}{12}, \frac{5\pi}{12}, \frac{3\pi}{4}, \frac{13\pi}{12}, \frac{17\pi}{12}, \frac{7\pi}{4}$

c $x = \frac{\pi}{6}, \frac{2\pi}{3}, \frac{7\pi}{6}, \frac{5\pi}{3}$

EXERCISE 11B

1 a 22 m b 100 s c $t \approx 31.5$ s, 68.5 s, 132 s, 168 s

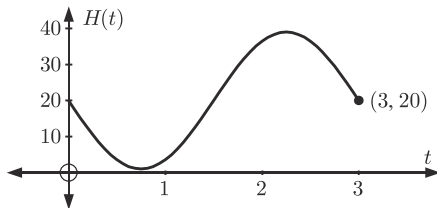
2 a i 7500 grasshoppers ii 10 300 grasshoppers
b 10 500 grasshoppers, when $t = 4$ weeks

c i at $t = 1\frac{1}{3}$ wks and $6\frac{2}{3}$ wks ii at $t = 9\frac{1}{3}$ wks

d $2.51 \leq t \leq 5.49$

3 a 20 m b at $t = \frac{3}{4}$ minute c 3 minutes

d



4 a 400 water buffalo

b i 577 water buffalo ii 400 water buffalo

c 650, which is the maximum population.

d 150, after 3 years e $t \approx 0.262$ years

5 a $H(t) = 3 \cos(\frac{\pi t}{2}) + 4$ b $t \approx 1.46$ s

6 a i true ii true b 116.8 cents L^{-1}

c on the 5th, 11th, 19th, and 25th days

d 98.6 cents L^{-1} on the 1st and 15th days

EXERCISE 11C.1

1 a $2 \sin \theta$ b $3 \cos \theta$ c $2 \sin \theta$ d $\sin \theta$

e $-2 \tan \theta$ f $-3 \cos^2 \theta$

2 a 3 b -2 c -1 d $3 \cos^2 \theta$

e $4 \sin^2 \theta$ f $\cos \theta$ g $-\sin^2 \theta$ h $-\cos^2 \theta$

i $-2 \sin^2 \theta$ j 1 k $\sin \theta$ l $\sin \theta$

3 a $2 \tan x$ b $\tan^2 x$ c $\sin x$ d $\cos x$

e $5 \sin x$ f $\frac{2}{\cos x}$

4 a $1 + 2 \sin \theta + \sin^2 \theta$ b $\sin^2 \alpha - 4 \sin \alpha + 4$

c $\tan^2 \alpha - 2 \tan \alpha + 1$ d $1 + 2 \sin \alpha \cos \alpha$

e $1 - 2 \sin \beta \cos \beta$ f $-4 + 4 \cos \alpha - \cos^2 \alpha$

5 $\sin^2 x - \tan^2 x$

EXERCISE 11C.2

1 a $(1 - \sin \theta)(1 + \sin \theta)$

b $(\sin \alpha + \cos \alpha)(\sin \alpha - \cos \alpha)$

c $(\tan \alpha + 1)(\tan \alpha - 1)$ d $\sin \beta(2 \sin \beta - 1)$

e $\cos \phi(2 + 3 \cos \phi)$ f $3 \sin \theta(\sin \theta - 2)$

g $(\tan \theta + 3)(\tan \theta + 2)$ h $(2 \cos \theta + 1)(\cos \theta + 3)$

i $(3 \cos \alpha + 1)(2 \cos \alpha - 1)$

2 a $1 + \sin \alpha$

b $\tan \beta - 1$

c $\cos \phi - \sin \phi$

d $\cos \phi + \sin \phi$ e $\frac{1}{\sin \alpha - \cos \alpha}$ f $\frac{\cos \theta}{2}$

EXERCISE 11D

1 a $\frac{24}{25}$ b $-\frac{7}{25}$ c $-\frac{24}{7}$ 2 a $-\frac{7}{9}$ b $\frac{1}{9}$

3 a $\cos \alpha = \frac{-\sqrt{5}}{3}$ b $\sin 2\alpha = \frac{4\sqrt{5}}{9}$

4 a $\sin \beta = \frac{-\sqrt{21}}{5}$ b $\sin 2\beta = \frac{-4\sqrt{21}}{25}$

5 a $\frac{1}{3}$ b $\frac{2\sqrt{2}}{3}$ 6 $\frac{3}{2}$

7 a $\sin 2\alpha$ b $2 \sin 2\alpha$ c $\frac{1}{2} \sin 2\alpha$ d $\cos 2\beta$

e $-\cos 2\phi$ f $\cos 2N$ g $-\cos 2M$ h $\cos 2\alpha$

i $-\cos 2\alpha$ j $\sin 4A$ k $\sin 6\alpha$ l $\cos 8\theta$

m $-\cos 6\beta$ n $\cos 10\alpha$ o $-\cos 6D$ p $\cos 4A$

q $\cos \alpha$ r $-2 \cos 6P$

9 a $x = 0, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}, 2\pi$ b $x = \frac{\pi}{2}, \frac{3\pi}{2}$ c $x = 0, \pi, 2\pi$

EXERCISE 11E

1 a $x = 0, \pi, \frac{7\pi}{6}, \frac{11\pi}{6}, 2\pi$ b $x = \frac{\pi}{3}, \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{3}$

c $x = \frac{\pi}{3}, \pi, \frac{5\pi}{3}$ d $x = \frac{7\pi}{6}, \frac{3\pi}{2}, \frac{11\pi}{6}$ e no solutions

2 a $x = 0, \frac{2\pi}{3}, \frac{4\pi}{3}, 2\pi$ b $x = \frac{\pi}{3}, \frac{5\pi}{3}$ c $x = \frac{\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}$

d $x = 0, \frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}, \pi, \frac{7\pi}{6}, \frac{3\pi}{2}, \frac{11\pi}{6}, 2\pi$

e $x = \frac{\pi}{4}$ f $x = \frac{\pi}{6}, \frac{5\pi}{6}$

REVIEW SET 11A

1 a $x \approx 115^\circ, 245^\circ, 475^\circ, 605^\circ$ b $x \approx 25^\circ, 335^\circ, 385^\circ$

2 a $x = \frac{7\pi}{6}, \frac{11\pi}{6}, \frac{19\pi}{6}, \frac{23\pi}{6}$ b $x = -\frac{7\pi}{4}, -\frac{5\pi}{4}, \frac{\pi}{4}, \frac{3\pi}{4}$

3 a $\frac{4\pi}{9}, \frac{5\pi}{9}, \frac{10\pi}{9}, \frac{11\pi}{9}, \frac{16\pi}{9}, \frac{17\pi}{9}$ b $\frac{3\pi}{4}, \frac{7\pi}{4}, \frac{11\pi}{4}$

4 $x = 0, \frac{3\pi}{2}, 2\pi, \frac{7\pi}{2}, 4\pi$

5 a $1 - \cos \theta$ b $\frac{1}{\sin \alpha + \cos \alpha}$ c $\frac{-\cos \alpha}{2}$

6 $\cos \alpha = -\frac{\sqrt{7}}{4}$, $\sin 2\alpha = \frac{3\sqrt{7}}{8}$

REVIEW SET 11B

1 a $x \approx 0.392, 2.75, 6.68$ b $x \approx 5.42$

2 a $x \approx 1.12, 5.17, 7.40$ b $x \approx 0.184, 4.62$

3 a $\frac{120}{169}$ b $\frac{119}{169}$ c $\frac{120}{119}$

4 a i $x \approx 1.33, 4.47, 7.61$ ii $x \approx 5.30$

iii $x \approx 2.83, 5.97, 9.11$

b i $x = -\frac{\pi}{2}, \frac{\pi}{2}$ ii $x = -\frac{2\pi}{3}, -\frac{\pi}{6}, \frac{\pi}{3}, \frac{5\pi}{6}$

iii $x = -\frac{2\pi}{3}, -\frac{\pi}{3}, \frac{\pi}{3}, \frac{2\pi}{3}$

c $x \approx 0.612, 3.754, 6.895$

5 a $x \approx 1.27, 5.02$ b $x = \frac{\pi}{12}, \frac{\pi}{4}, \frac{3\pi}{4}, \frac{11\pi}{12}, \frac{17\pi}{12}, \frac{19\pi}{12}$

c $x \approx 1.09, 2.05$

6 a 5000 b 3000, 7000 c $0.5 < t < 2.5$ and $6.5 < t \leq 8$

7 $x \approx 1.37, 5.44, 7.65$