Solution *Section* 3.1– Introduction

Exercise

Indicate the angle if it is an acute or obtuse. Then give the complement and the supplement of each angle.

a) 10° *b*) 52° *c*) 90° *d*) 120° *e*) 150°

Solution

a) Acute;
Complement is $90° - 10° = 80°$;
Supplement is $180° - 10° = 170°$.

b) Acute;
Complement is $90° - 52° = 38°$;
Supplement is $180° - 52° = 128°$.

c) Neither (*right angle*);
Complement is $90° - 90° = 0°$;
Supplement is $180° - 90° = 90°$.

d) Obtuse;
Complement is $90° - 120° = -30°$;
Supplement is $180° - 120° = 60°$.

e) Obtuse;
Complement is $90° - 150° = -60°$;
Supplement is $180° - 150° = 30°$.

Exercise

Change to decimal degrees

a) 10° 45′ *c)* 274° 18′ 59″ *e)* 98° 22′ 45″ *g)* 1° 2′ 3″
b) 34° 51′ 35″ *d)* 74° 8′ 14″ *f)* 9° 9′ 9″ *h)* 73° 40′ 40″

Solution

a) $10° \; 45' = 10° + 45'$

$$= 10° + 45' \frac{1°}{60'}$$

$$= 10° + 0.75°$$

$$= 10.75°$$

b) $34° \; 51' \; 35'' = 34° + 51' + 35''$

$$= 34° + 51' \cdot \frac{1°}{60'} + 35'' \cdot \frac{1°}{3600''}$$

$$= 34° + 0.85° + 0.00972°$$

$= 34.85972°$

c) $274°\ 18'\ 59'' = 274° + 18' + 59''$

$= 274° + 18' \cdot \frac{1°}{60'} + 59'' \cdot \frac{1°}{3600''}$

$= 274° + 0.3° + 0.016389°$

$= 274.316389°$

d) $74°\ 8'\ 14'' = 74° + \frac{8°}{60} + \frac{14°}{3600}$

$= 74° + 0.1333° + 0.0039°$

$= 74.137°$

e) $98°\ 22'\ 45'' = 98° + 22' + 45''$

$= 98° + 22' \cdot \frac{1°}{60'} + 45'' \cdot \frac{1°}{3600''}$

$= 98° + 0.36667° + 0.0125°$

$= 98.37917°$

f) $9°\ 9'\ 9'' = 9° + 9' + 9''$

$= 9° + 9' \cdot \frac{1°}{60'} + 9'' \cdot \frac{1°}{3600''}$

$= 9° + 0.15° + 0.0025°$

$= 9.1525°$

g) $1°\ 2'\ 3'' = 1° + 2' + 3''$

$= 1° + 2' \cdot \frac{1°}{60'} + 3'' \cdot \frac{1°}{3600''}$

$= 1° + 0.03333° + 0.000833°$

$= 1.034163°$

h) $73°\ 40'\ 40'' = 73° + 40' + 40''$

$= 73° + 40' \cdot \frac{1°}{60'} + 40'' \cdot \frac{1°}{3600''}$

$= 73° + 0.6667° + 0.0111°$

$= 73.67778°$

Exercise

Convert to degrees, minutes, and seconds.

a) 89.9004°	*c)* 122.6853°	*e)* 44.01°	*g)* 29.411°
b) 34.817°	*d)* 178.5994°	*f)* 19.99°	*h)* 18.255°

Solution

a) $89.9004^\circ = 89^\circ + 0.9004^\circ$

$= 89^\circ + 0.9004^\circ \cdot (60')$

$= 89^\circ \quad 54.024'$

$= 89^\circ \quad 54' + 0.024'$

$= 89^\circ \quad 54' \quad 0.024' \cdot (60'')$

$= 89^\circ \quad 54' \quad 1.44''$

b) $34.817^\circ = 34^\circ + 0.817^\circ$

$= 34^\circ + 0.817(60')$

$= 34^\circ + 49.02'$

$= 34^\circ + 49' + .02(60'')$

$= 34^\circ + 49' + 1.2''$

$= 34^\circ \; 49' \; 1.2''$

c) $122.6853^\circ = 122^\circ + .6853^\circ$

$= 122^\circ + \quad 0.6853 \cdot (60')$

$= 122^\circ \quad 41.118'$

$= 122^\circ \quad 41' + 0.118'$

$= 122^\circ \quad 41' \quad 0.118 \cdot (60'')$

$= 122^\circ \quad 41' \quad 7.1''$

d) $178.5994^\circ = 178^\circ + .5994^\circ$

$= 178^\circ + \quad .5994 \cdot (60')$

$= 178^\circ \quad 35.964'$

$= 178^\circ \quad 35' + .964'$

$= 178^\circ \quad 35' \quad 0.964 \cdot (60'')$

$= 178^\circ \quad 35' \quad 57.84''$

e) $44.01^\circ = 44^\circ + .01^\circ$

$= 44^\circ + \quad .01 \cdot (60')$

$= 44^\circ \quad 0.6'$

$$= 44^\circ \quad 0.6 \cdot (60'')$$
$$= 44^\circ \quad 36''$$

f) $19.99^\circ = 19^\circ + .99^\circ$
$$= 19^\circ + \quad .99 \cdot (60')$$
$$= 19^\circ \quad 59.4'$$
$$= 19^\circ \quad 59' + 0.4'$$
$$= 19^\circ \quad 59' \quad 0.4 \cdot (60'')$$
$$= 19^\circ \quad 59' \quad 24''$$

g) $29.411^\circ = 29^\circ + 0.411^\circ$
$$= 29^\circ + \quad 0.411 \cdot (60')$$
$$= 29^\circ \quad 24.66'$$
$$= 29^\circ \quad 24' + 0.66'$$
$$= 29^\circ \quad 24' \quad 0.66 \cdot (60'')$$
$$= 29^\circ \quad 24' \quad 39.6''$$

h) $18.255^\circ = 18^\circ + 0.255^\circ$
$$= 18^\circ + \quad 0.255 \cdot (60')$$
$$= 18^\circ \quad 15.3'$$
$$= 18^\circ \quad 15' + 0.3'$$
$$= 18^\circ \quad 15' \quad 0.3 \cdot (60'')$$
$$= 18^\circ \quad 15' \quad 18''$$

Exercise

Perform each calculation

a) $51^\circ\ 29' + 32^\circ\ 46'$ *b)* $90^\circ - 73^\circ 12'$ *c)* $90^\circ - 36^\circ\ 18'\ 47''$ *d)* $75^\circ\ 15' + 83^\circ\ 32'$

Solution

a) $51^\circ 29' + 32^\circ 46'$

$$\begin{array}{rr} 51^\circ & 29' \\ +32^\circ & 46' \\ \hline 83^\circ & 75' \end{array}$$

$83^\circ \quad 75' = 1^\circ 15'$ $\boxed{84^\circ \quad 15'}$

b) $90^\circ - 73^\circ 12'$

$$\begin{array}{r} 89^\circ \quad 60' \\ -\,73^\circ \quad 12' \\ \hline 16^\circ \quad 48' \end{array}$$

c) $90^\circ - 36^\circ\ 18'\ 47''$

$$\begin{array}{r} 90^\circ \\ -\,36^\circ \quad 18' \quad 47'' \\ \hline \end{array} \quad \Rightarrow \quad \begin{array}{r} 89^\circ \quad 59' \quad 60'' \\ -\,36^\circ \quad 18' \quad 47'' \\ \hline 53^\circ \quad 41' \quad 13'' \end{array}$$

d) $75^\circ\ 15' + 83^\circ\ 32'$

$$\begin{array}{r} 75^\circ \quad 15' \\ 83^\circ \quad 32' \\ \hline 158^\circ \quad 47' \end{array}$$

Exercise

Find the angle of least possible positive measure coterminal with an angle of

a) -75° *b)* -800° *c)* 270°

Solution

a) $360^\circ - 75^\circ = 285^\circ$

b) $3(360^\circ) - 800^\circ = 280^\circ$

c) $360^\circ + 270^\circ = 630^\circ$

Exercise

A vertical rise of the Forest Double chair lift 1,170 *feet* and the length of the chair lift as 5,570 *feet*. To the nearest foot, find the horizontal distance covered by a person riding this lift.

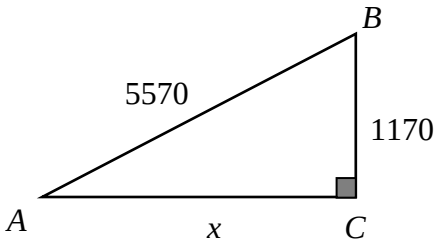
Solution

$$x^2 + 1170^2 = 5570^2$$

$$x^2 = 5570^2 - 1170^2$$

$$x = \sqrt{5570^2 - 1170^2}$$

$$\underline{x = 5,445.73 \ \ ft}$$



Exercise

A tire is rotating 600 times per minute. Through how many degrees does a point of the edge of the tire move in $\frac{1}{2}$ *second*?

Solution

$$\frac{1}{2}600\frac{rev}{\min}\cdot\frac{1\min}{60\sec}\cdot\frac{360°}{1rev} \underline{= 1800 \ \ deg/sec}$$

Exercise

A windmill makes 90 *revolutions* per *minute*. How many revolutions does it make per *second*?

Solution

$$90\frac{rev}{\min}\cdot\frac{1\min}{60\sec} \underline{= 1.5 \ \ rev/\sec}$$

Exercise

Convert to radians

a) $256°\ 20'$ *b)* $-78.4°$ *c)* $330°$ *d)* $-60°$ *e)* $-225°$

Solution

a) $256°\ 20' = 256° + \frac{20°}{60}$

$$= 256° + \frac{2°}{6}$$

$$= \frac{1538°}{6} = \left(\frac{769}{3}\right)^{\circ}$$

$$\frac{769°}{3}\frac{\pi}{180°} \underline{= \frac{769\pi}{540} \ rad} \ \underline{\approx 4.47 \ rad}$$

b) $-78.4° = -78.4°\left(\frac{\pi}{180°}\right) rad$

$$\approx -1.37\ rad$$

c) $330° = 330°\left(\frac{\pi}{180°}\right) rad$

$$= \frac{11\pi}{6}\ rad$$

d) $-60° = -60°\left(\frac{\pi}{180°}\right) rad$

$$= -\frac{\pi}{3}\ rad$$

e) $-225° = -225°\left(\frac{\pi}{180°}\right) rad$

$$= -\frac{5\pi}{4}\ rad$$

Exercise

Convert to degrees

a) $\frac{11\pi}{6}$ *c)* $\frac{\pi}{6}$ *e)* $\frac{\pi}{3}$ *g)* -4π

b) $-\frac{5\pi}{3}$ *d)* 2.4 *f)* $-\frac{5\pi}{12}$ *h)* $\frac{7\pi}{13}$

Solution

a) $\frac{11\pi}{6}\ (rad) = \frac{11\pi}{6} \bullet \frac{180°}{\pi}$

$$= 330°$$

b) $-\frac{5\pi}{3}(rad) = -\frac{5\pi}{3} \bullet \frac{180°}{\pi}$

$$= -300°$$

c) $\frac{\pi}{6}(rad) = \frac{\pi}{6}\left(\frac{180}{\pi}\right)^{\circ}$

$$= 30^{\circ}$$

d) $2.4\ rad = 2.4 \bullet \frac{180°}{\pi}$

$$= \frac{432°}{\pi}$$

$$\approx 137.5°$$

e) $\frac{\pi}{3}(rad) = \frac{\pi}{3}\left(\frac{180}{\pi}\right)^{\circ}$

$= 60^{\circ}$

f) $-\frac{5\pi}{12}(rad) = -\frac{5\pi}{12}\left(\frac{180}{\pi}\right)^{\circ}$

$= -75^{\circ}$

g) $-4\pi(rad) = -4\pi\left(\frac{180}{\pi}\right)^{\circ}$

$= -720^{\circ}$

h) $\frac{7\pi}{13}(rad) = \frac{7\pi}{13}\left(\frac{180}{\pi}\right)^{\circ}$

$\approx 96.923^{\circ}$