Exercise 6.1

Unit 6 · Trigonometry and Bearing

$1^\circ = 60'$ $\quad 1' = 60''$ $\quad 1^\circ = 3600''$ $\quad 1^\circ = \frac{\pi}{180}$ rad $\quad 1$ rad $= \left(\frac{180}{\pi}\right)^\circ$

1 Convert the following angles into seconds.

(i) 5°

$= 5 \times 3600''$

$\therefore 18000''$

(ii) $30'$

$= 30 \times 60''$

$\therefore 1800''$

(iii) $10^\circ 30'$

$= 10 \times 3600'' + 30 \times 60''$

$= 36000'' + 1800''$

$\therefore 37800''$

(iv) $20^\circ 20' 20''$

$= 20 \times 3600'' + 20 \times 60'' + 20''$

$= 72000'' + 1200'' + 20''$

$\therefore 73220''$

2 Convert the following into minutes.

(i) 75°

$= 75 \times 60'$

$\therefore 4500'$

(ii) $120''$

$= \left(\frac{120}{60}\right)'$

$\therefore 2'$

(iii) $50^\circ 40'$

$= 50 \times 60' + 40'$

$= 3000' + 40'$

$\therefore 3040'$

(iv) $30^\circ 30' 30''$

$= 30 \times 60' + 30' + \left(\frac{30}{60}\right)'$

$= 1800' + 30' + 0.5'$

$\therefore 1830.5'$

3 Convert the following into degrees.

(i) $135'$

$= \left(\frac{135}{60}\right)^\circ$

$\therefore 2.25^\circ$

(ii) $150''$

$= \left(\frac{150}{3600}\right)^\circ$

$\therefore 0.0417^\circ$

(iii) $60°60'$

$= 60° + \left(\frac{60}{60}\right)°$

$= 60° + 1°$

$\therefore 61°$

(iv) $45°45'45''$

$= 45° + \left(\frac{45}{60}\right)° + \left(\frac{45}{3600}\right)°$

$= 45° + 0.75° + 0.0125°$

$\therefore 45.7625°$

4 Write in D°M'S" form.

(i) $60.125°$

$= 60° + (0.125 \times 60)'$

$= 60° + 7.5'$

$= 60° + 7' + (0.5 \times 60)''$

$\therefore 60°7'30''$

(ii) $135.375''$

$= \left(\frac{135}{60}\right)' + 0.375''$

$= 2.25' + 0.375''$

$= 2' + (0.25 \times 60)'' + 0.375''$

$= 2' + 15.375''$

$\therefore 0°2'15''$ (approx.)

(iii) $60.85'$

$= 60' + (0.85 \times 60)''$

$= 60' + 51''$

$= \left(\frac{60}{60}\right)° + 51''$

$\therefore 1°0'51''$

(iv) $255.45°$

$= 255° + (0.45 \times 60)'$

$= 255° + 27'$

$\therefore 255°27'0''$

In (ii) the angle is taken as 135.375 seconds, as in the notes. If the book gives 135.375° (degrees), the answer is 135°22'30".

5 Convert into radians (in terms of π).

(i) $45°$

$= 45 \times \frac{\pi}{180}$ rad

$\therefore \frac{\pi}{4}$ rad

(ii) $150°$

$= 150 \times \frac{\pi}{180}$ rad

$\therefore \frac{5\pi}{6}$ rad

(iii) $60°30'$

$$= 60° + \left(\frac{30}{60}\right)° = 60.5°$$

$$= 60.5 \times \frac{\pi}{180} \text{ rad}$$

$$\therefore \frac{121\pi}{360} \text{ rad}$$

(iv) $120°$

$$= 120 \times \frac{\pi}{180} \text{ rad}$$

$$\therefore \frac{2\pi}{3} \text{ rad}$$

6 Convert into radians (taking $\pi = 3.1416$).

(i) $270°$

$$= 270 \times \frac{3.1416}{180} \text{ rad}$$

$$\therefore 4.7124 \text{ rad}$$

(ii) $60°$

$$= 60 \times \frac{3.1416}{180} \text{ rad}$$

$$\therefore 1.0472 \text{ rad}$$

(iii) $180°45'$

$$= 180° + \left(\frac{45}{60}\right)° = 180.75°$$

$$= 180.75 \times \frac{3.1416}{180} \text{ rad}$$

$$\therefore 3.1547 \text{ rad}$$

(iv) $75°30'45''$

$$= 75° + 0.5° + 0.0125° = 75.5125°$$

$$= 75.5125 \times \frac{3.1416}{180} \text{ rad}$$

$$\therefore 1.3179 \text{ rad}$$

7 Convert the radian measures into degrees (D°M'S").

(i) $\frac{\pi}{4}$

$$= \frac{\pi}{4} \times \left(\frac{180}{\pi}\right)° = \left(\frac{180}{4}\right)°$$

$$\therefore 45°$$

(ii) $\frac{5\pi}{6}$

$$= \frac{5\pi}{6} \times \left(\frac{180}{\pi}\right)° = \left(\frac{5 \times 180}{6}\right)°$$

$$\therefore 150°$$

(iii) $\frac{\pi}{12}$

$$= \frac{\pi}{12} \times \left(\frac{180}{\pi}\right)° = \left(\frac{180}{12}\right)°$$

$$\therefore 15°$$

(iv) $\frac{7\pi}{40}$

$$= \frac{7\pi}{40} \times \left(\frac{180}{\pi}\right)° = 31.5°$$

$$= 31° + (0.5 \times 60)'$$

$$\therefore 31°30'0''$$

(v) 1 rad

$$= 1 \times \left(\frac{180}{\pi}\right)^\circ = 57.2956^\circ \quad (\pi = 3.1416)$$

$$= 57^\circ + (0.2956 \times 60)' = 57^\circ + 17.736'$$

$$= 57^\circ + 17' + (0.736 \times 60)'' = 57^\circ + 17' + 44.16''$$

$\therefore 57^\circ 17' 44''$

(vi) 3.1416 rad

$$= 3.1416 \times \left(\frac{180}{3.1416}\right)^\circ$$

$\therefore 180^\circ$

(vii) 12π rad

$$= 12\pi \times \left(\frac{180}{\pi}\right)^\circ = 12 \times 180^\circ$$

$\therefore 2160^\circ$

(viii) 5 rad

$$= 5 \times \left(\frac{180}{3.1416}\right)^\circ = 286.4782^\circ$$

$$= 286^\circ + (0.4782 \times 60)' = 286^\circ + 28.692'$$

$$= 286^\circ + 28' + (0.692 \times 60)'' = 286^\circ + 28' + 41.52''$$

$\therefore 286^\circ 28' 42''$ (approx.)