Pearson Edexcel

# Angles in all four quadrants

**A LEVEL LINKS**
**Scheme of work:** 4a. Trigonometric ratios and graphs

## Key points

- The sine, cosine and tangent of some angles may be written exactly.

| | 0 | 30° | 45° | 60° | 90° |
|---|---|---|---|---|---|
| **sin** | 0 | $\frac{1}{2}$ | $\frac{\sqrt{2}}{2}$ | $\frac{\sqrt{3}}{2}$ | 1 |
| **cos** | 1 | $\frac{\sqrt{3}}{2}$ | $\frac{\sqrt{2}}{2}$ | $\frac{1}{2}$ | 0 |
| **tan** | 0 | $\frac{\sqrt{3}}{3}$ | 1 | $\sqrt{3}$ | |

- You can use these rules to find sin, cos and tan of any positive or negative angle using the corresponding cute angle made with the $x$-axis, $\theta$.

$\sin(180° - \theta) = \sin\theta$
$\cos(180° - \theta) = -\cos\theta$
$\tan(180° - \theta) = -\tan\theta$
$\sin(180° + \theta) = -\sin\theta$
$\cos(180° + \theta) = -\cos\theta$
$\tan(180° + \theta) = \tan\theta$

## Practice questions

**1** Without using a calculator, write down the values of:

(a) sin 90° (b) cos 270° (c) tan 360° (d) sin 270°

**2** Express the following in terms of trigonometric ratios of acute angles:

(a) sin (− 200°) b) cos (− 200°) (c) tan (− 40°) (d) tan 335°

**3** Express the following as trigonometric ratios of either 30°, 45° or 60°, and hence find their exact values:

(a) sin (− 135°) (b) cos 225° (c) tan (− 120°) (d) sin (− 200°)

**4.**

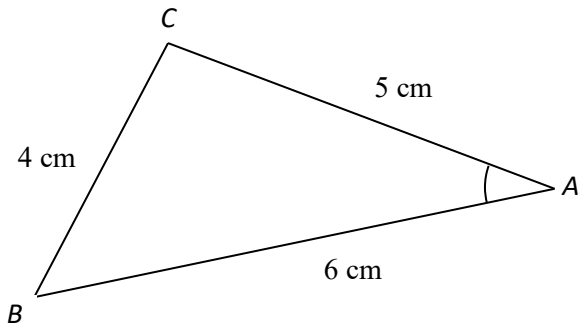


**Figure 1**

Figure 1 shows the triangle $ABC$, with $AB = 6$ cm, $BC = 4$ cm and $CA = 5$ cm.

($a$) Show that $\cos A = \frac{3}{4}$.

($b$) Hence, or otherwise, find the exact value of $\sin A$.

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## Answers

**1** (a) 1 (b) 0 (c) 0 (d) − 1

**2** (a) sin 20° (b) − cos 20° (c) − tan 40° (d) − tan 25°

**3** (a) $-\frac{1}{\sqrt{2}}$ (b) $-\frac{1}{\sqrt{2}}$ (c) $\sqrt{3}$ (d) $--\frac{\sqrt{3}}{2}$

**4** (a) $4^2 = 5^2 + 6^2 - (2 \times 5 \times 6 \cos\theta)$

$\cos\theta = \frac{5^2 + 6^2 - 4^2}{2 \times 5 \times 6}$

$\left(= \frac{45}{60}\right) = \frac{3}{4}$

(b) $\sin^2 A + \left(\frac{3}{4}\right)^2 = 1$

$\left(\sin^2 A = \frac{7}{16}\right) \quad \sin A = \frac{1}{4}\sqrt{7}$