AQA, Edexcel, OCR, MEI

A Level

A Level Mathematics

C2 Trigonometry (Answers)

Name:

MME

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Total Marks: /68

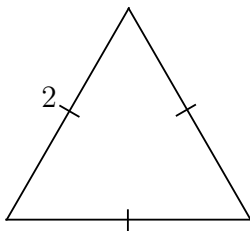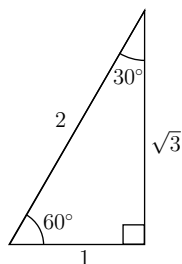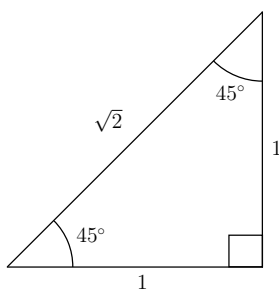1. Consider the equilateral triangle below:

Figure 1: An equilateral triangle of side length 2.

(a) We simply split the triangle into two equal pieces as suggested and after a bit of pythagoras obtain:

From here, simple trigonometry yields $\sin 30° = \frac{1}{2}$ and $\cos 30° = \frac{\sqrt{3}}{2}$ as required. [3]

(b) For example, we construct the triangle:

From here, simple trigonometry yields $\cos 45° = \sin 45° = \frac{1}{\sqrt{2}}$ as required.

[3]

(c) $\cos(-45°) = \frac{1}{\sqrt{2}}$ and $\sin(-45)° = -\frac{1}{\sqrt{2}}$. [3]

(d) $\frac{\pi}{4}$. [2]

(e) $\sin \frac{3\pi}{4} = \frac{1}{\sqrt{2}}$ and $\cos \frac{3\pi}{4} = -\frac{1}{\sqrt{2}}$. [2]

2. Simplify the following expresions:

    (a) 1.   [1]

    (b) $2 + \sin^2(2\theta)$.   [2]

    (c) $\sin \theta$.   [2]

    (d) 1.   [2]

    (e) $\tan \theta$.   [3]

    (f) $\frac{1}{\cos^2 \theta}$ (or $\sec^2 \theta$).   [3]

3. $x = 45°, 225°$.   [3]

4. $x = 45°, 135°, 225°, 315°$.   [3]

5. $x = \frac{\pi}{18}, \frac{11\pi}{18}, \frac{13\pi}{18}, \frac{23\pi}{18}, \frac{25\pi}{18}, \frac{35\pi}{18}$.   [4]

6. $x = \frac{\pi}{4}, \frac{5\pi}{4}$.   [4]

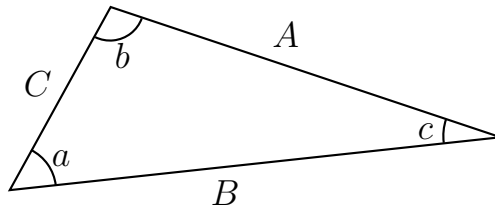7. $x = \frac{\pi}{2}, \frac{\pi}{6}, \frac{5\pi}{6}$.   [4]

8. Consider the triangle below:

Figure 2: A triangle with side lengths A, B, C and angles a, b, c.

    (a) area= $\frac{1}{2}AB \sin c$.   [1]

    (b) $\frac{\sin a}{A} = \frac{\sin b}{B} = \frac{\sin c}{C}$.   [2]

    (c) $A^2 = B^2 + C^2 - 2BC \cos a$.   [2]

    (d) Area= $\frac{15\sqrt{3}}{2}$.   [2]

    (e) $C = \sqrt{31}$.   [3]
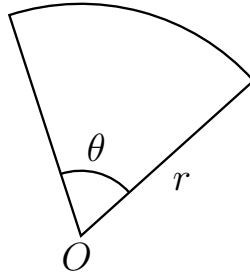
9. Consider the sector of a circle below:

Figure 3: A circle sector of radius r and angle θ.

(a) $S = r\theta$. [1]

(b) $A = \frac{1}{2}r^2\theta$. [2]

(c) $A = \frac{25\pi}{6}$. [2]

(d) Be Careful! We are given an angle in *degrees*. We must convert this to radians first. The answer is

$$S = \frac{8\pi}{9}.$$

[2]

10. Consider the sector of a circle below. The shaded segment R is bounded by a chord on the circle.
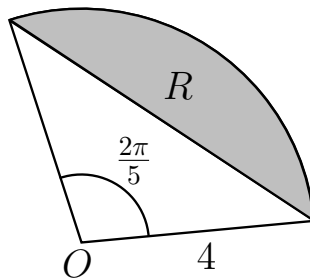

Figure 4: A circle sector of radius 4 and angle $\frac{2\pi}{5}$.

(a) $A = \frac{16\pi}{5}$. [2]

(b) We first calculate the area of the triangle to be $\frac{1}{2} \times 4 \times 4 \times \sin\frac{2\pi}{5} = 7.60845\cdots$. Thus, the area of R is $\frac{16\pi}{5} - 7.60845\cdots = 2.4446\cdots$. Hence the area of the shaded region R is 2.44 (to two decimal places). [5]