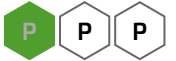


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# Circles 4i

A Level



A circle with centre  $C$  has the equation  $x^2 + y^2 - 10x + 4y + 4 = 0$ .

## Part A Find the coordinates of $C$

By completing the square for  $x$  and  $y$  find the coordinates of  $C$ . Enter the  $x$  and  $y$  coordinates below.

Enter the  $x$  coordinate:

The following symbols may be useful:  $x$

---

Enter the  $y$  coordinate:

The following symbols may be useful:  $y$

---

## Part B Find radius

Find the radius of the circle.

---

### Part C Find tangent

Find the equation of the tangent to the circle at the point  $P(8, 2)$ . Give your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$ , and  $c$  are integers.

The following symbols may be useful:  $x$ ,  $y$

---

### Part D Find area

The circle meets the  $y$  axis at  $Q$  and the tangent to the circle at  $P$  (as in part C) meets the  $y$  axis at  $R$ . Find the area of triangle  $PQR$ .

---

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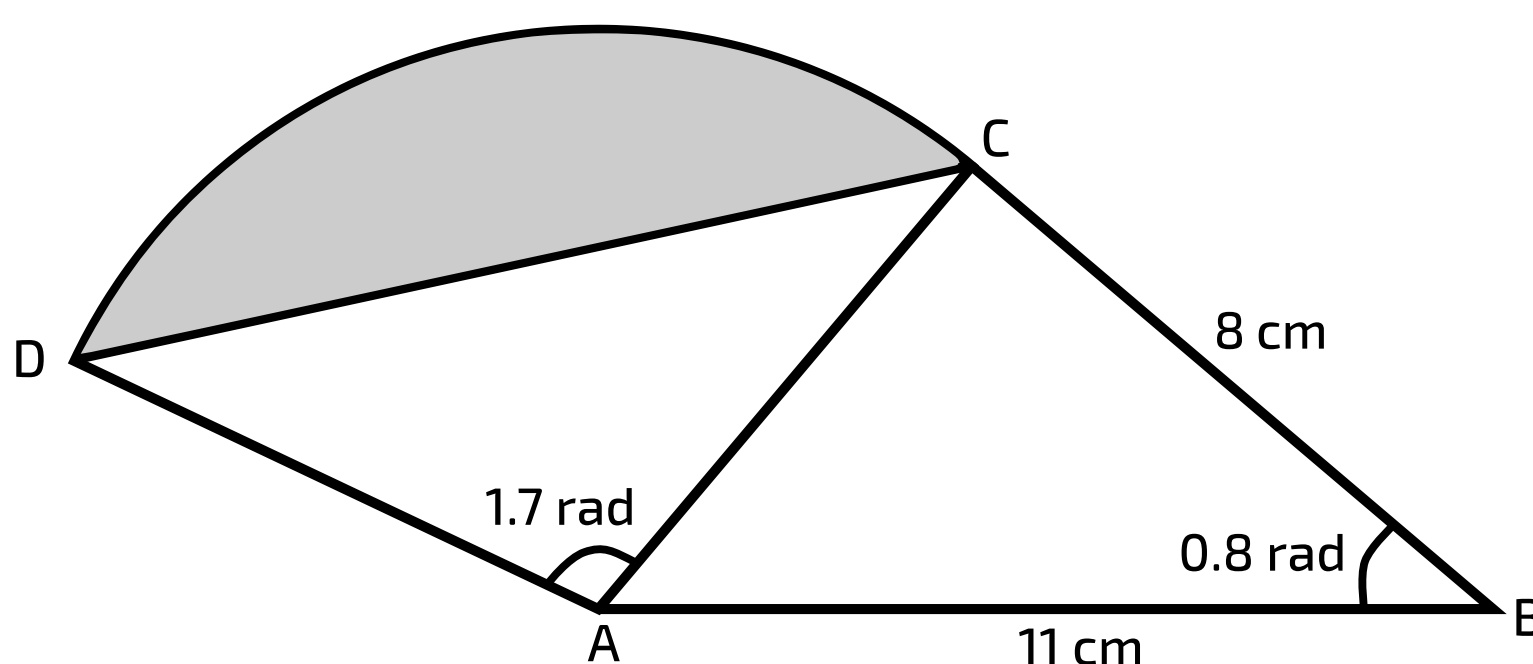
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# Radians 2i

A Level



**Figure 1** shows a triangle  $ABC$ , and a sector  $ACD$  of a circle with centre  $A$ . It is given that  $AB = 11$  cm,  $BC = 8$  cm, angle  $ABC = 0.8$  radians and angle  $DAC = 1.7$  radians. The shaded segment is bounded by the line  $DC$  and the arc  $DC$ .



**Figure 1:** Diagram showing triangle  $ABC$  and the sector  $ACD$ .

## Part A Length $AC$

Calculate the length of  $AC$  correct to 3 significant figures.

## Part B Area of segment

Find the area of the shaded segment. Give your answer to 3 significant figures.

## Part C Perimeter of segment

Find the perimeter of the shaded segment. Give your answer to 3 significant figures.

---

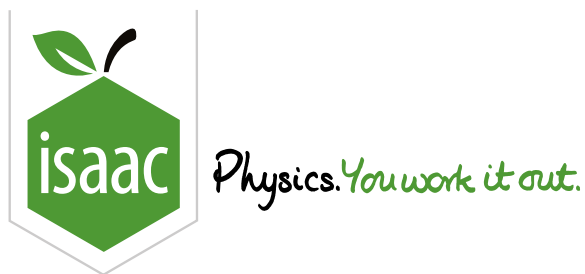
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# Small Angle Approximations 3ii

A Level



## Part A Expression

Use the small angle approximation to write an approximate expression for  $(\cos \theta + 5)(1 + \sin(2\theta))$  in powers of  $\theta$  up to  $\theta^2$ .

The following symbols may be useful:  $\theta$

---

## Part B Approximation

Use your answer from the above part to work out an approximate value for  $(\cos \theta + 5)(1 + \sin(2\theta))$  when  $\theta = 0.075$ . Give your answer to 3 significant figures.

---

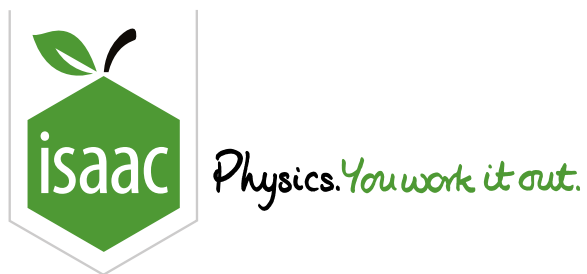
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# Functions: Reciprocal Trig 3i

A Level



It is given that  $\theta$  is the acute angle such that  $\sec \theta \sin \theta = 36 \cot \theta$ .

## Part A Value of $\tan \theta$

Find  $\tan \theta$ .

The following symbols may be useful: `cos()`, `sin()`, `tan()`, `theta`

---

## Part B Value of $\tan \left( \theta - \frac{\pi}{4} \right)$

Hence, using an appropriate formula, find the exact value of  $\tan \left( \theta - \frac{\pi}{4} \right)$ .

The following symbols may be useful: `pi`, `theta`

---

## Part C Value of $\tan (2\theta)$

Using an appropriate formula, find the exact value of  $\tan (2\theta)$ .

The following symbols may be useful: `theta`

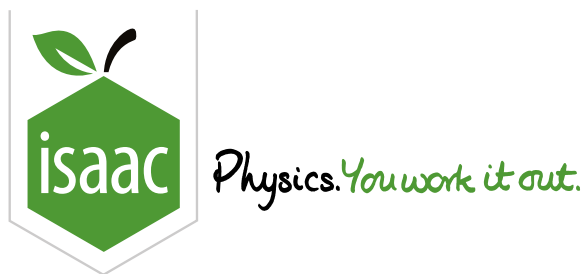
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# Trigonometry: Double Angles 2i

A Level



## Part A Proof

Simplify  $\sin(2\theta)(\tan\theta + \cot\theta)$  as far as possible.

The following symbols may be useful: theta

---

## Part B Exact Value

Hence find the exact value of  $\tan\frac{\pi}{12} + \tan\frac{\pi}{8} + \cot\frac{\pi}{12} + \cot\frac{\pi}{8}$ .

---

## Part C Solve

Using your answer to part A, solve the equation  $\sin(4\theta)(\tan\theta + \cot\theta) = 1$  for  $0 < \theta < \frac{\pi}{2}$ , to three significant figures, giving your answer in **radians**.

---



**Part D**  $(1 - \cos(2\theta)) \left( \tan \frac{\theta}{2} + \cot \frac{\theta}{2} \right)^3$

Using your answer to part A, express  $(1 - \cos(2\theta))^2 \left( \tan \frac{\theta}{2} + \cot \frac{\theta}{2} \right)^3$  in terms of  $\sin \theta$ .

The following symbols may be useful:  $\theta$

---

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# Trigonometry: Combined Angles 4i

A Level



## Part A Combined Angles

Express  $4 \cos \theta - 2 \sin \theta$  in the form  $R \cos (\theta + \alpha)$ , where  $R > 0$  and  $0^\circ < \alpha < 90^\circ$ .

Give the exact value of  $R$ .

The following symbols may be useful:  $R$

---

Give the value of  $\alpha$  to three significant figures.

---

## Part B $4 \cos \theta - 2 \sin \theta = 3$

Hence solve the equation  $4 \cos \theta - 2 \sin \theta = 3$  for  $0^\circ < \theta < 360^\circ$ , giving your answers in degrees to three significant figures.

Give the smallest solution.

---

Give the largest solution.

---

**Part C**     $25 - (4 \cos \theta - 2 \sin \theta)^2$

Using your answer to part A, determine the greatest and least values of

$$25 - (4 \cos \theta - 2 \sin \theta)^2$$

as  $\theta$  varies, and, in each case, find the smallest positive value of  $\theta$  for which that value occurs, giving your answers in degrees, to three significant figures.

Give the smallest value of  $\theta$  which corresponds to the maximum value.

---

Give the smallest value of  $\theta$  which corresponds to the minimum value.

---

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# Trigonometry: Combined Angles 2i

A Level



## Part A Proof

Use the identity for  $\cos(A + B)$  to write  $4 \cos(\theta + 60^\circ) \cos(\theta + 30^\circ)$  in the form  $p + q \sin(r\theta)$ , where  $p, q, r \in \mathbb{R}$ .

The following symbols may be useful:  $\theta$

## Part B $4 \cos 82.5^\circ \cos 52.5^\circ$

Hence find the exact value of  $4 \cos 82.5^\circ \cos 52.5^\circ$ .

## Part C Solve

Solve, for  $0^\circ < \theta < 90^\circ$ , the equation  $4 \cos(\theta + 60^\circ) \cos(\theta + 30^\circ) = 1$ .

Give the smallest solution, in degrees, to three significant figures.

Give the largest solution, in degrees, to three significant figures.

## Part D Values of $k$

Given that there are no values of  $\theta$  which satisfy the equation

$$4 \cos (\theta + 60^\circ) \cos (\theta + 30^\circ) = k,$$

determine the set of values of the constant  $k$ .

Give one of the bounds, in the form  $k < a$ ,  $k \leq a$ ,  $k > a$  or  $k \geq a$  where  $a$  is an exact value.

The following symbols may be useful:  $<$ ,  $\leq$ ,  $>$ ,  $\geq$ ,  $k$

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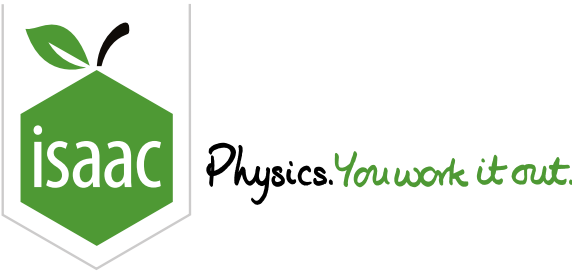
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# Sketching Inverse Trigonometric Functions 2

A Level

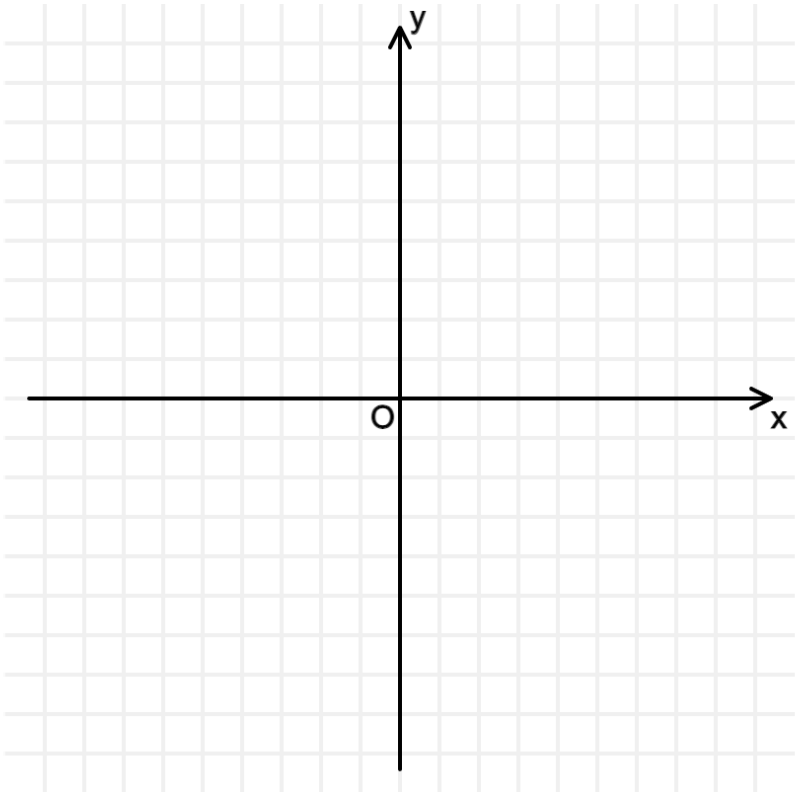
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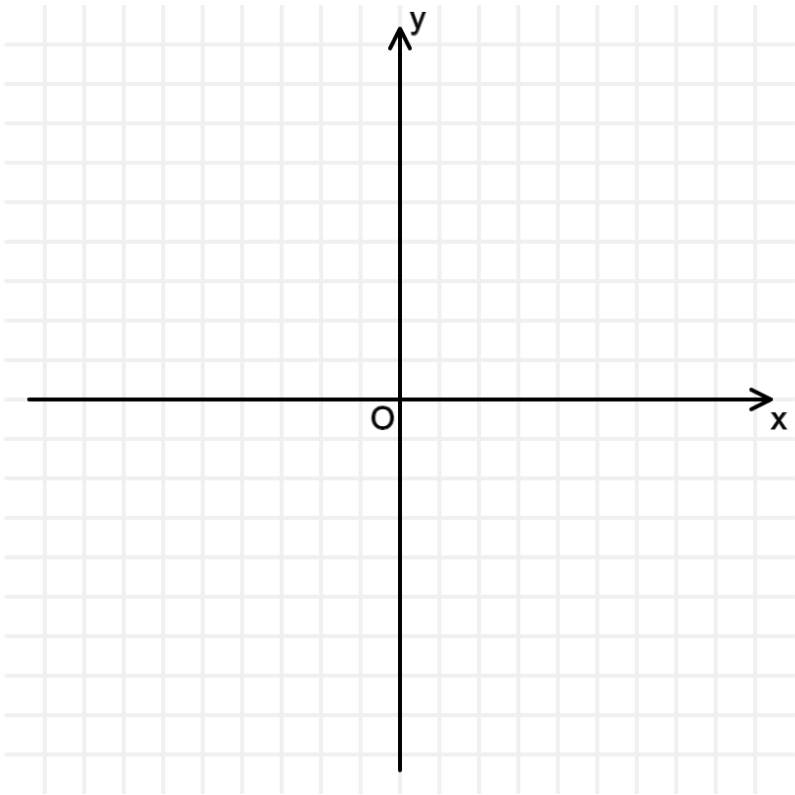
**Part A**   Sketch  $\arccos(x - 1) - 1$

Sketch the graph of  $y = \arccos(x - 1) - 1$ .



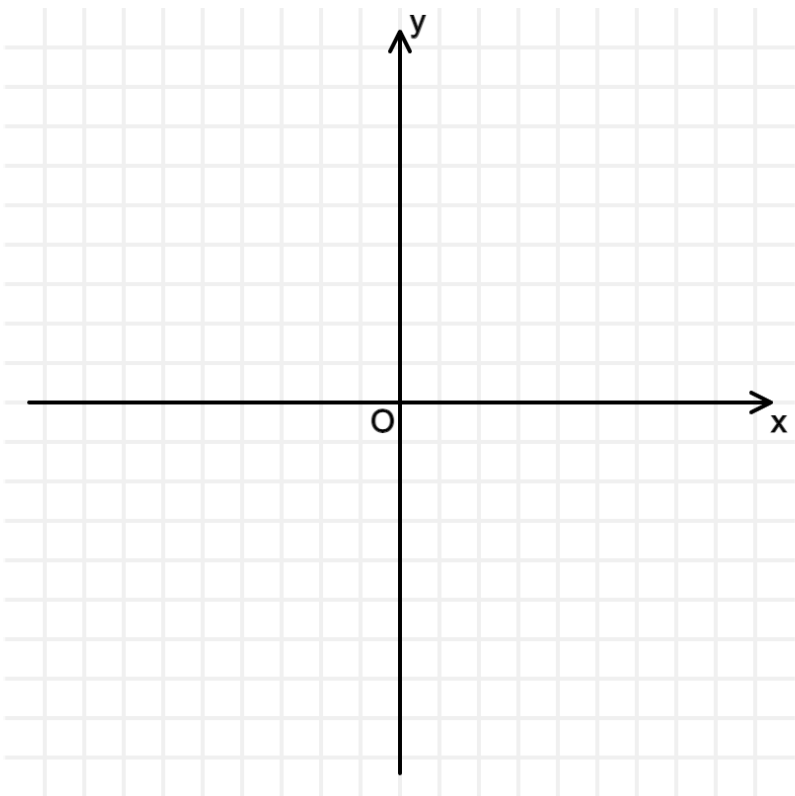
Part B    Sketch  $\frac{\pi}{2} - 2 \arctan x$

Sketch the graph of  $y = \frac{\pi}{2} - 2 \arctan x$ .



Part C    Sketch  $\arcsin (2x - 1) - \frac{\pi}{2}$

Sketch the graph of  $y = \arcsin (2x - 1) - \frac{\pi}{2}$ .



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