Trigonometric formulae

Question 1.

2016 Paper 2, Q3

(a) Show that
$$\frac{\cos 7A + \cos A}{\sin 7A - \sin A} = \cot 3A$$
.

Radians

Question 2.

2014 Paper 2, Q2

(b) The diagram shows part of the circular end of a running track with three running lanes shown. The centre of each of the circular boundaries of the lanes is at O.

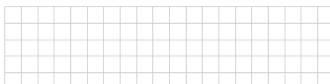
Kate runs in the middle of lane 1, from A to B as shown.

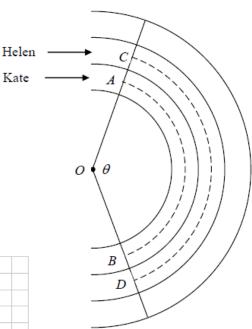
Helen runs in the middle of lane 2, from C to D as shown.

Helen runs 3 m further than Kate.

$$|\angle AOB| = |\angle COD| = \theta$$
 radians.

If each lane is 1.2 m wide, find θ .





Solving equations

Question 3.

2016 Paper 2, Q3

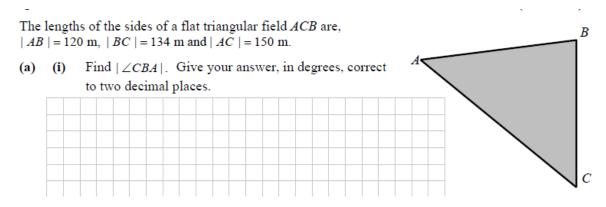
(b) Given that $\cos 2\theta = \frac{1}{9}$, find $\cos \theta$ in the form $\pm \frac{\sqrt{a}}{b}$, where $a, b \in \mathbb{N}$.



Sine rule, cosine rule, area of a triangle

Question 4.

2014 Paper 2, Q1



(ii) Find the area of the triangle ACB correct to the nearest whole number.

Question 5.

2013 Paper 2, Q5

- (b) In a triangle XYZ, |XY| = 5 cm, |XZ| = 3 cm and $|\angle XYZ| = 27^{\circ}$.
 - (i) Find the two possible values of | ∠XZY |. Give your answers correct to the nearest degree.
 - (c) In the case that | \(\angle XZY\)| < 90°, write down | \(\angle ZXY\)|, and hence find the area of the triangle XYZ, correct to the nearest integer.</p>

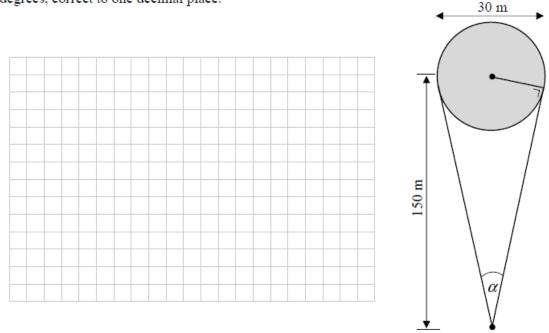


Longer questions

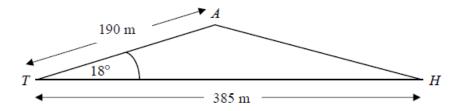
Question 6.

2015 Paper 2, Q9 [45 marks]

(a) Joan is playing golf. She is 150 m from the centre of a circular green of diameter 30 m. The diagram shows the range of directions in which Joan can hit the ball so that it could land on the green. Find α, the measure of the angle of this range of directions. Give your answer, in degrees, correct to one decimal place.



(b) At the next hole, Joan, at T, attempts to hit the ball in the direction of the hole H. Her shot is off target and the ball lands at A, a distance of 190 metres from T, where | ∠ATH | = 18°.
| TH | is 385 metres. Find | AH |, the distance from the ball to the hole, correct to the nearest metre.



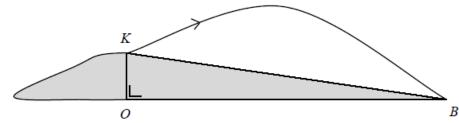
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(c) At another hole, where the ground is not level, Joan hits the ball from K, as shown. The ball lands at B. The height of the ball, in metres, above the horizontal line OB is given by

$$h = -6t^2 + 22t + 8$$

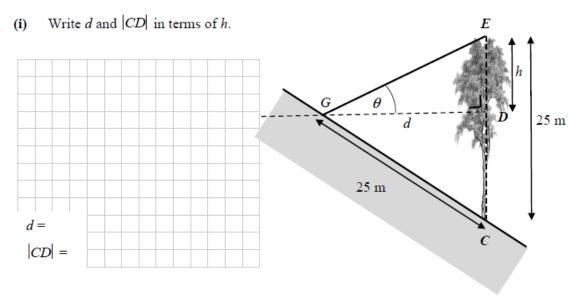
where t is the time in seconds after the ball is struck and h is the height of the ball.



- Find the height of K above OB.
- (ii) The horizontal speed of the ball over the straight distance [OB] is a constant 38 m s⁻¹. Find the angle of elevation of K from B, correct to the nearest degree.
- (d) At a later hole, Joan's first shot lands at the point G, on ground that is sloping downwards, as shown. A vertical tree, [CE], 25 metres high, stands between G and the hole. The distance, |GC|, from the ball to the bottom of the tree is also 25 metres.

The angle of elevation at G to the top of the tree, E, is θ , where $\theta = \tan^{-1} \frac{1}{2}$.

The height of the top of the tree above the horizontal, GD, is h metres and |GD| = d metres.



(ii) Hence, or otherwise, find h.



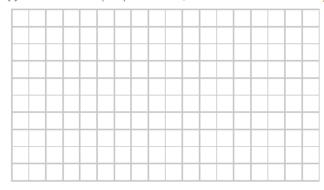
Question 7.

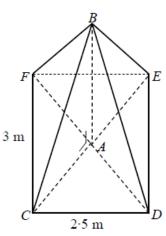
2016 Paper 2, Q7 [55 marks]

A glass Roof Lantern in the shape of a pyramid has a rectangular base CDEF and its apex is at B as shown. The vertical height of the pyramid is |AB|, where A is the point of intersection of the diagonals of the base as shown in the diagram.

Also |CD| = 2.5 m and |CF| = 3 m.

(a) (i) Show that |AC| = 1.95 m, correct to two decimal places.





- (ii) The angle of elevation of B from C is 50° (i.e. $|\angle BCA| = 50^{\circ}$). Show that |AB| = 2.3 m, correct to one decimal place.
- (iii) Find |BC|, correct to the nearest metre.
- (iv) Find |∠BCD|, correct to the nearest degree.
- (v) Find the area of glass required to glaze all four triangular sides of the pyramid. Give your answer correct to the nearest m².
- (b) Another Roof Lantern, in the shape of a pyramid, has a square base CDEF. The vertical height |AB| = 3 m, where A is the point of intersection of the diagonals of the base as shown.

The angle of elevation of *B* from *C* is 60° (i.e. $|\angle BCA| = 60^{\circ}$).

Find the length of the side of the square base of the lantern. Give your answer in the form \sqrt{a} m, where $a \in \mathbb{N}$.

