Society of Actuaries in Ireland

# Trigonometry 2 Questions

## Exercises:

Q1. On the same graph, plot the following in the range $[0,2\pi]$:

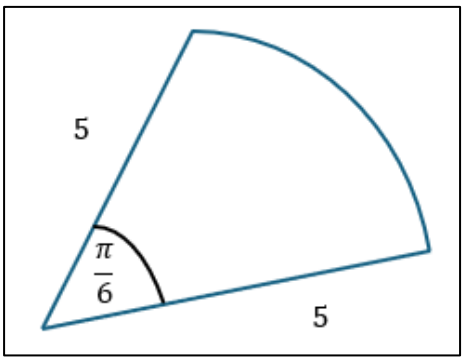
- y = cos(x)
- y = 3cos(x)

Q2. On the same graph, plot the following in the range $[0,2\pi]$:

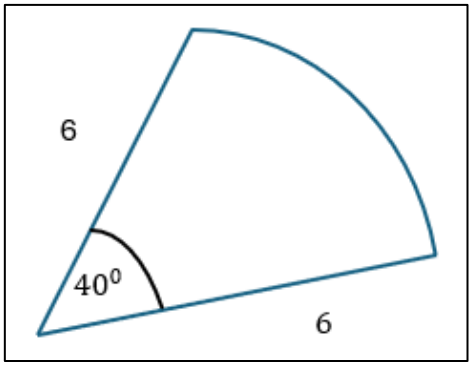
- y = 3sin(x)
- y = sin(2x)
- y = 2 + sin(x)

Q3. Find the length of the arc and area of the sector from the below:

(i)




(ii)




Q4. Find the general solution to Cos$\theta$ = $-\frac{\sqrt{3}}{2}$.

Q5. Find the general solution to tan$\theta$ = $\sqrt{3}$.

Q6. Find the solution for Sin3$\theta$ = $\frac{1}{2}$, $0 \leq \theta \leq 360^0$

## Exam Questions:

Q1. 2021 Paper 2 Question 4b

**(b)** Solve the equation: $\tan(B + 150°) = -\sqrt{3}$,

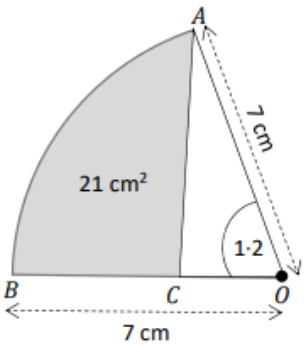
for $0° \leq B \leq 360°$.

Q2. 2020 Paper 2 Question 4

**(a)** Find the two values of $\theta$ for which $\tan\frac{\theta}{2} = -\frac{1}{\sqrt{3}}$, where $0 \leq \theta \leq 4\pi$.

**(b)** The diagram shows $OAB$, a sector of a circle of radius 7 cm with centre $O$.
In the sector, $|\angle BOA| = 1{\cdot}2$ radians.
The area of the shaded region is 21 cm$^2$.

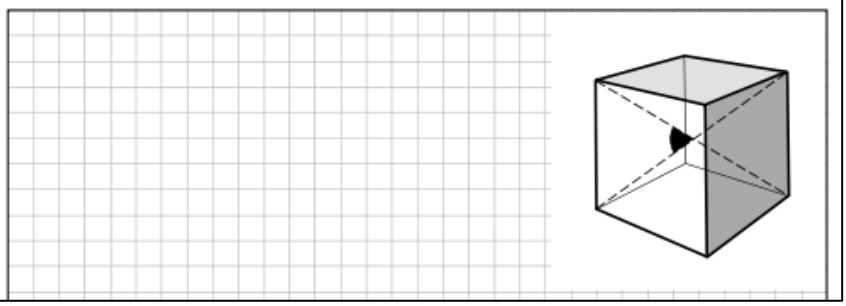
Find $|BC|$.
Give your answer correct to 1 decimal place.




Q3. 2019 Paper 2 Question Q4b

# Trigonometry 2 Questions

**(b)** Find the cosine of the acute angle between two diagonals of a cube.



Q4. 2018 Paper 2 Question 4

**(a)** Find **all** the values of $x$ for which $\cos(2x) = -\frac{\sqrt{3}}{2}$, where $0° \leq x \leq 360°$.

**(b)** Let $\cos A = \frac{y}{2}$, where $0° < A < 90°$. Write $\sin(2A)$ in terms of $y$.

Q5. 2018 Paper 2 Question 9

In the diagrams below, the crank $[OD]$ rotates about the fixed point $O$. The point $C$ slides back and forth in a horizontal line. $[CD]$ is the rod that connects $C$ to the crank. The diagrams below show three of the possible positions for $C$ and $D$. $|OD| = 10$ cm and $|DC| = 30$ cm.

**Diagram 1**
(Starting position)

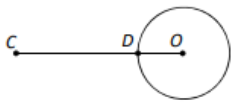



**Diagram 2**

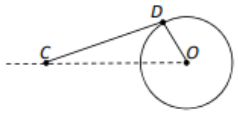
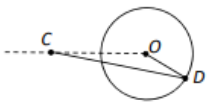
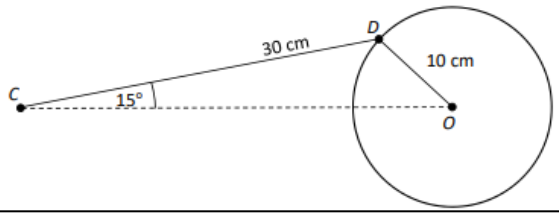



**Diagram 3**




**(a)** The diagram below shows a particular position of the mechanism with $|\angle DCO| = 15°$.
Find $|\angle COD|$, correct to the nearest degree.



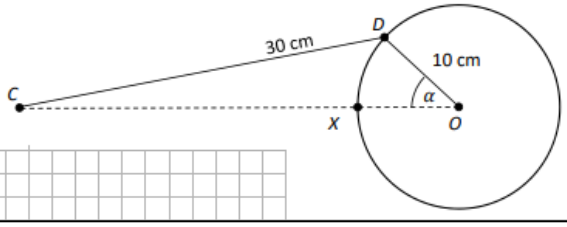

**(b)** As $D$ moves in a circle around $O$, the angle $\alpha$ in the diagram below increases.
The distance $|CX|$ can be considered to be a function of $\alpha$ and written as $f(\alpha)$.

**(i)** Write down the period and range of $f$.

| Period = | Range = |
|---|---|

**(ii)** Complete the table below for $f(\alpha)$.
Give your answers correct to 2 decimal places where appropriate.
(**Note: Diagram 1** at the start of this question represents $\alpha = 0°$).

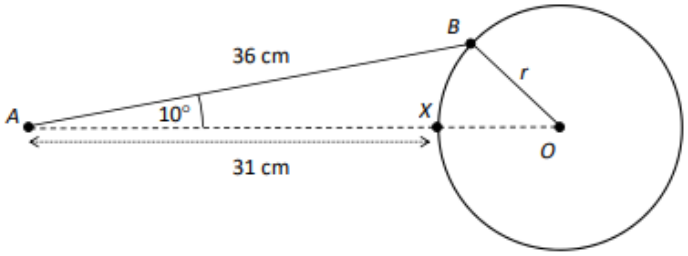
| $\alpha$ | 0° | 90° | 180° | 270° | 360° |
|---|---|---|---|---|---|
| $f(\alpha)$ (cm) | 30 | | | | |



# Trigonometry 2 Questions

**(iii)** Use your values from the table to draw a rough sketch of $f$ in the domain $0° \leq \alpha \leq 360°$.

**(c)** The diagram below shows another crank-and-slider mechanism with different dimensions.
In the diagram, $|AB| = 36$ cm, $|AX| = 31$ cm, and $|\angle BAO| = 10°$.
(**Note**: $|\angle OBA| \neq 90°$)
Find $r$, the length of the crank. Give your answer in cm, correct to the nearest cm.



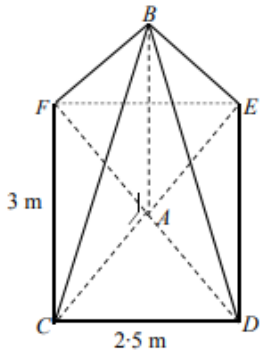

## Q6. 2016 Paper 2 Question 7

**Question 7** **(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 $|CD| = 2{\cdot}5$ m and $|CF| = 3$ m.

**(a)** **(i)** Show that $|AC| = 1{\cdot}95$ m, correct to two decimal places.






**(ii)** The angle of elevation of $B$ from $C$ is 50° (i.e. $|\angle BCA| = 50°$).
Show that $|AB| = 2{\cdot}3$ m, correct to one decimal place.

**(iii)** Find $|BC|$, correct to the nearest metre.

**(iv)** Find $|\angle BCD|$, 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 $m^2$.

**(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. $|\angle BCA| = 60°$).
Find the length of the side of the square base of the lantern.
Give your answer in the form $\sqrt{a}$ m, where $a \in \mathbb{N}$.