Trigonometry Test Review Paper 2

1. The following diagram shows triangle ABC.

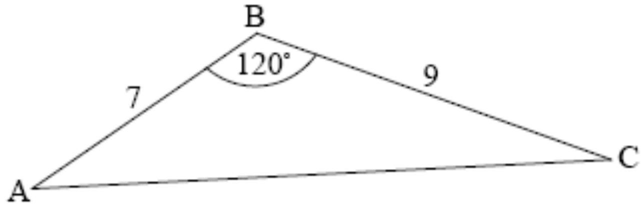

diagram not to scale

AB = 7 cm, BC = 9 cm and $\hat{ABC} = 120°$.

(a) Find AC.

(3)

(b) Find $\hat{BAC}$.

(3)
(Total 6 marks)

3. The circle shown has centre O and radius 3.9 cm.

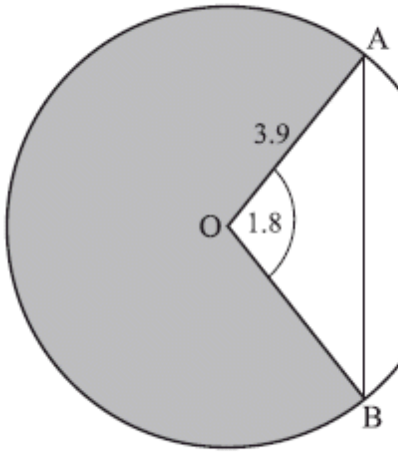

diagram not to scale

Points A and B lie on the circle and angle AOB is 1.8 radians.

(a) Find AB.

(3)

(b) Find the area of the shaded region.

(4)
(Total 7 marks)

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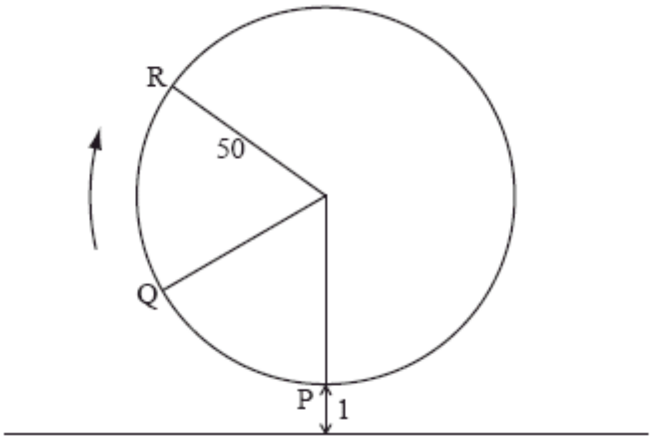
2. The following diagram represents a large Ferris wheel at an amusement park.
The points P, Q and R represent different positions of a seat on the wheel.



The wheel has a radius of 50 metres and rotates clockwise at a rate of one revolution every 30 minutes.

A seat starts at the lowest point P, when its height is one metre above the ground.

(a) Find the height of a seat above the ground after 15 minutes.

(2)

(b) After six minutes, the seat is at point Q. Find its height above the ground at Q.

(5)

The height of the seat above ground after t minutes can be modelled by the function
$h(t) = 50 \sin (b(t - c)) + 51$.

(c) Find the value of b and of c.

(6)

(d) Hence find the value of t the first time the seat is 96 m above the ground.

(3)
(Total 16 marks)

4. Let $f(x) = \frac{3x}{2} +1$, $g(x) = 4\cos\left(\frac{x}{3}\right) - 1$. Let $h(x) = (g \circ f)(x)$.

(a) Find an expression for $h(x)$.

(3)

(b) Write down the period of h.

(1)

(c) Write down the range of h.

(2)
(Total 6 marks)

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5. The diagram below shows a triangle ABD with AB = 13 cm and AD = 6.5 cm.
Let C be a point on the line BD such that BC = AC = 7 cm.

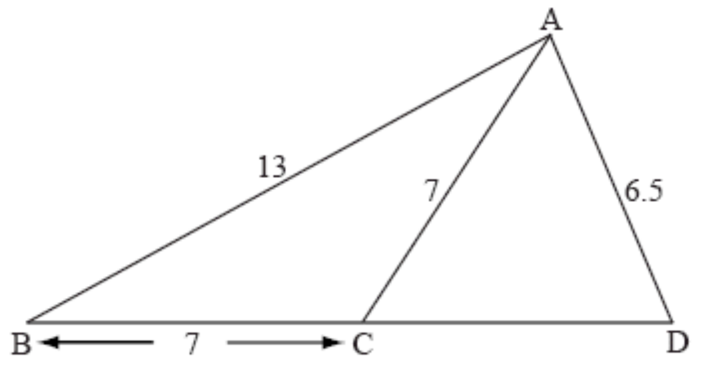


diagram not to scale

(a) Find the size of angle ACB.

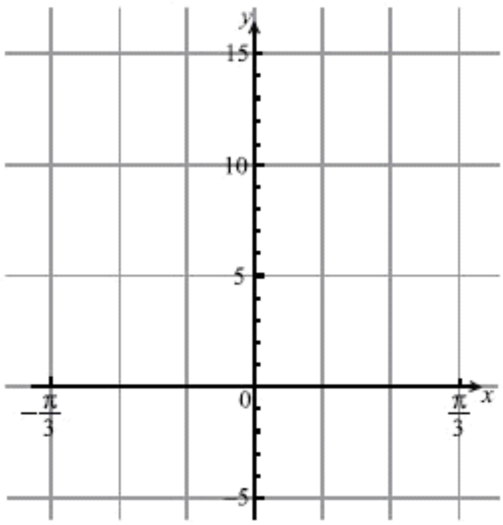
(3)

(b) Find the size of angle CAD.

(5)
(Total 8 marks)

6. Let $f(x) = 4\tan^2 x - 4\sin x$, $-\frac{\pi}{3} \leq x \leq \frac{\pi}{3}$.

(a) On the grid below, sketch the graph of $y = f(x)$.



(3)

(b) Solve the equation $f(x) = 1$.

(3)
(Total 6 marks)

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7. (a) Consider the equation $4x^2 + kx + 1 = 0$. For what values of k does this equation have two **equal** roots?

(3)

Let f be the function $f(\theta) = 2\cos 2\theta + 4\cos\theta + 3$, for $-360° \le \theta \le 360°$.

(b) Show that this function may be written as $f(\theta) = 4\cos^2\theta + 4\cos\theta + 1$.

(1)

(c) Consider the equation $f(\theta) = 0$, for $-360° \le \theta \le 360°$.

(i) How many distinct values of $\cos\theta$ satisfy this equation?

(ii) Find all values of θ which satisfy this equation.

(5)

(d) Given that $f(\theta) = c$ is satisfied by only three values of θ, find the value of c.

(2)
(Total 11 marks)

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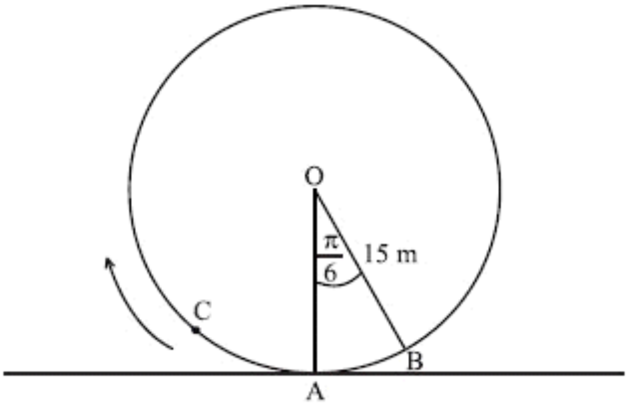
8. A Ferris wheel with centre O and a radius of 15 metres is represented in the diagram below.

Initially seat A is at ground level. The next seat is B, where $\text{A}\hat{\text{O}}\text{B} = \frac{\pi}{6}$.



(a) Find the length of the arc AB.

(2)

(b) Find the area of the sector AOB.

(2)

(c) The wheel turns clockwise through an angle of $\frac{2\pi}{3}$. Find the height of A above the ground.

(3)

The height, h metres, of seat C above the ground after t minutes, can be modelled by the function

$$h(t) = 15 - 15\cos\left(2t + \frac{\pi}{4}\right).$$

(d) (i) Find the height of seat C when $t = \frac{\pi}{4}$.

(ii) Find the initial height of seat C.

(iii) Find the time at which seat C first reaches its highest point.

(8)

(Total 15 marks)

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9. The depth y metres of water in a harbour is given by the equation

$$y = 10 + 4\sin\left(\frac{t}{2}\right),$$

where t is the number of hours after midnight.

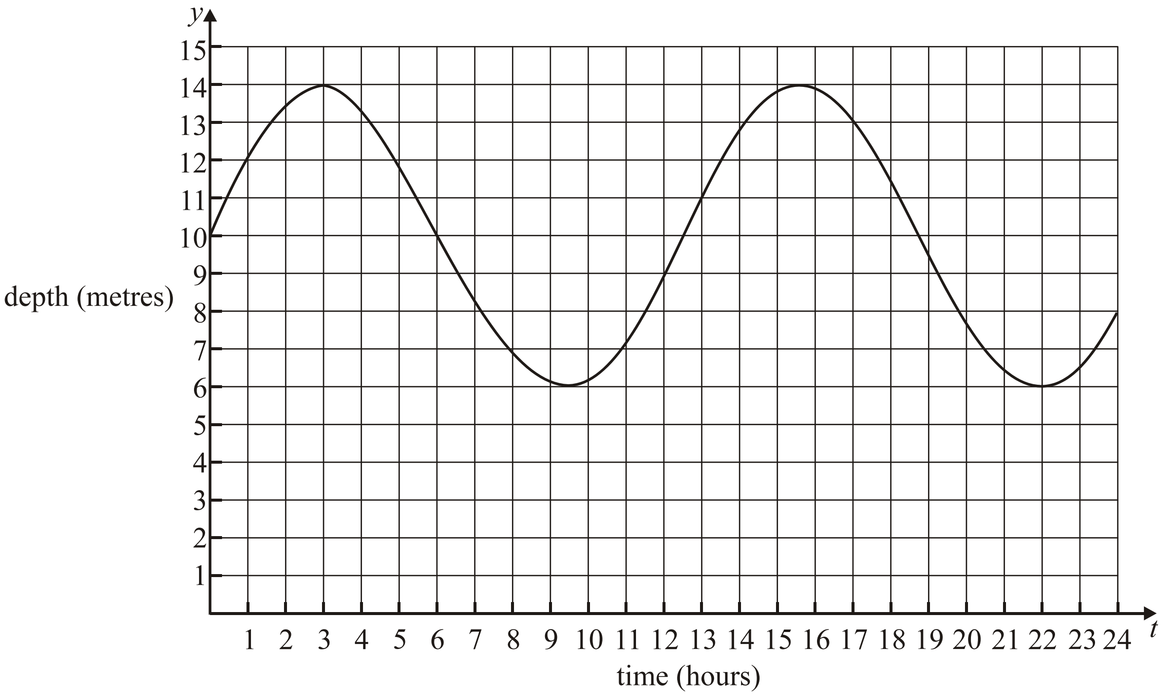
(a) Calculate the depth of the water

(i) when $t = 2$;

(ii) at 2100.

(3)

The sketch below shows the depth y, of water, at time t, during one day (24 hours).



(b) (i) Write down the maximum depth of water in the harbour.

(ii) Calculate the value of t when the water is first at its maximum depth during the day.

(3)

The harbour gates are closed when the depth of the water is less than seven metres. An alarm rings when the gates are opened or closed.

(c) (i) How many times does the alarm sound during the day?

(ii) Find the value of t when the alarm sounds first.

(iii) Use the graph to find the length of time during the day when the harbour gates are closed. Give your answer in hours, to the nearest hour.

(7)
(Total 13 marks)