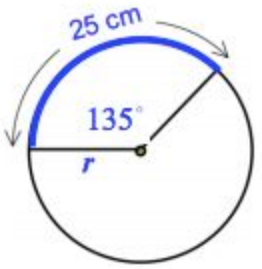
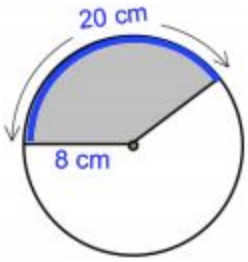
Math SL PROBLEM SET 94

1. The following questions deal with radians, arcs and sectors:

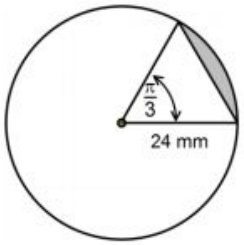


   a. Find the radius r of the circle in the figure to the right. (In this figure, the arc with length of 25 cm subtends a central angle of 135°)



   b. Find the area of the shaded region in the figure.

   c. Find the area of the shaded region in the figure below.



2. θ is an acute angle and $\cos\theta = \frac{2}{3}$. Find the exact values of (a) $\cos 2\theta$, and (b) $\tan\theta$.

3. Find the possible areas for triangle ABC given AB = 11 cm, BC = 8 cm and angle A = 40°.

4. The triangle ABC is such that BC = 10.2 cm, $\angle BAC = x$, $\angle ABC = 2x$ and $\angle ABC$ is an obtuse angle.

   a. Find AC in terms of $\cos x$.
   b. Given that the area of triangle ABC is $52.02\cos x$, find $\angle ACB$.

5. A ship sails from a harbour for 20 km on a bearing of 025° and then continues due east for 18 km.

   a. How far will the ship have to sail to get back to the harbour by the shortest route?
   b. What will be the bearing of this return trip?

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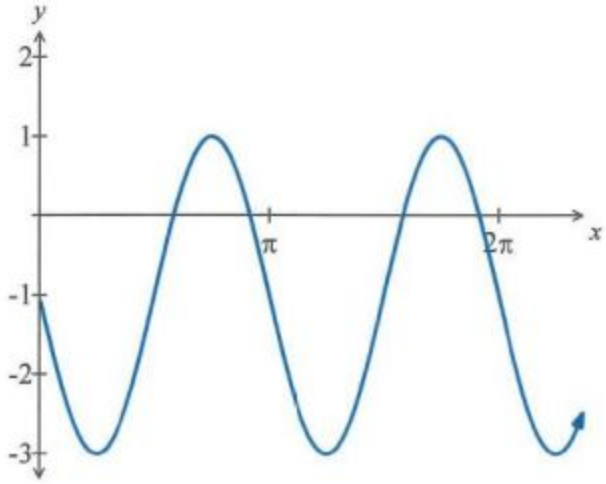
6. Anna and Tanya, who are both 1.75 m tall, both look at the top of Cleopatra's Needle in Central Park, New York. Anna's line of sight to the top makes an angle of 40 with the horizontal and Tanya's line of sight makes an angle of 50° with the horizontal. If they are standing 7 m apart, how tall is the needle?

7. a. Write the expression $\cos(2x) + \sin(x)$ in terms of $\sin(x)$ only.
   b. Solve the equation $\cos(2x) + \sin(x) = 0$ for $0 \leq x \leq 2\pi$, giving your answer exactly.

8. The depth of water, h meters, measured at a sea pier t hours after midnight is given by the function $h(t) = a + b\cos\left(\frac{2\pi}{k}t\right)$, where a, b and k are constants. The water is at a maximum depth of 22 meters at midnight and noon, and is at a minimum depth of 14 m at 06:00 and at 18:00.

   a. Write down the values of: (i) a (ii) b (iii) k
   b. Solve the equation $h(t) = 16$ where $0 \leq t \leq 24$.
   c. Find the rate of change of the water depth at $t = 8$ hours.

9. The graph included below shows the equation of $g(x) = a \sin(bx) + c$, where a, b and c are integers.



   a. Determine the values of a, b and c.
   b. g has two x-intercepts at $x_1 = K$ and $x_2 = M$, where $0 < x_1 < x_2 < \pi$. Determine the values of K and M.
   c. Evaluate $\int_K^M g(x)dx$.