Math SL PROBLEM SET 10

Arc pSection A (Short Answer)

1. **(T3.1 - N) (CA)** There is another way to measure angles in trigonometry. Let us examine this new method. A circle has 360°, a circle can also be said to have 2π ***radians***. Using this information answer the following questions: ***(Cirrito 9.7.1, p309)***

   a. Convert these angles from degrees into radians:

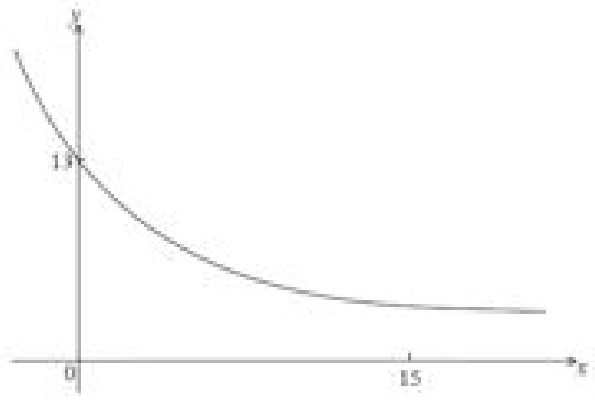
      i. 75° ii. 240° iii. 90°

   b. Convert these angles from radians into degrees:

      i. $\frac{\pi}{3}$ ii. $\frac{3\pi}{4}$ iii. π

2. **(F2.7 - E) (CA)** Let $f(x) = kx^2 + kx$ and let $g(x) = x - 0.8$. The graphs of $f(x)$ and $g(x)$ intersect at two distinct points. Determine **ALL** the possible values of k. ***(Cirrito 2.4.1, p41)***

3. **(F2.6 - R) (CA)** Let $f(x) = Ae^{kx} + 3$. Part of the graph of f is shown below. The y-intercept of the function is at (0, 13). ***(Cirrito 5.3.3, p131)***



   a. Show that $A = 10$.

   b. Given that $f(15) = 3.49$ (correct to 3 significant figures), find the value of k.

   c. Let $g(x) = -x^2 + 12x - 24$. Solve the inequality $g(x) > f(x)$.

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4. **(T3.1 - N) (CA)** Consider the following circle with centre O and radius 6.8 cm. ***(Cirrito 9.7, p309)***

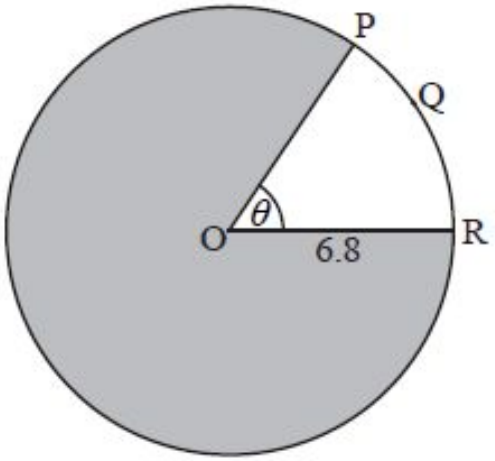

diagram not to scale

The length of the arc PQR is 8.5 cm.

a. Given that the formula for arc length is $l = \theta r$, find the value of θ.

b. You can find the area of a ***sector of a circle*** by using the formula $A = \frac{1}{2}\theta r^2$. using this formula, find the area of the sector OPR.

c. Hence, determine the area of the shaded region of the circle above.

5. **(SP5.6 - R) (CI)** A box contains six red marbles and two blue marbles. Anna selects a marble from the box. She replaces the marble and then selects a second marble. ***(Oxford 3.5, p89)***

a. Write down the probability that the first marble Anna selects in red.

b. Find the probability that Anna selects two red marbles.

c. Find the probability that one marble is red and marble is blue.

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6. **(T3.6 - R) (CA)** The following diagram shows triangle ABC. ***(Cirrito 9.5.4, p300)***

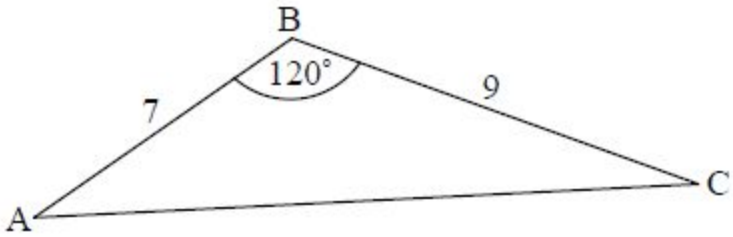

diagram not to scale

a. Find AC.

b. Find angle BAC.

Section B (Extended Response/Investigation)

7. **(F2.5 - E) (CI)** Let $f(x) = 3x - 2$ and $g(x) = \frac{5}{3x}$, for $x \neq 0$. ***(Cirrito 5.4.2, p157; Cirrito 5.4.1, p148)***

Let $h(x) = \frac{5}{x+2}$, for $x \geq 0$. The graph of h has a horizontal asymptote at $y = 0$.

a. Find $f^{-1}(x)$.

b. Show that $(g \circ f^{-1})(x) = \frac{5}{x+2}$.

c. Find the y-intercept of the graph of h. Hence, sketch the graph of h.

d. For the graph of h^{-1}, write down the x-intercept; also write down the equation of the vertical asymptote.

e. Given that $h^{-1}(a) = 3$, find the value of a.

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8. **(F2.8 - E) (CA)** The following diagram shows two ships A and B. At noon, ship A was 15 km due north of ship B. Ship A was moving south at 15 km/h and ship B was moving east at 11km/h. ***(Cirrito 3.1.2, p65)***

   a. Find the distance between the ships at

      i. 13:00;

      ii. 14:00.

   b. Let $s(t)$ be the distance between the ships t hours after noon, for $0 \le t \le 4$. Show that $s(t) = \sqrt{346t^2 - 450t + 225}$.

   c. Sketch the graph of $s(t)$.

   d. Due to poor weather, the captain of ship A can only see another ship if they are less than 8 km apart. Can the captain see ship B at anytime between noon and 16:00? Justify your response.