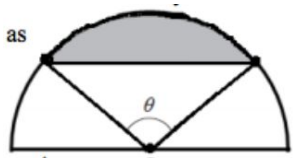# Math SL PROBLEM SET 54

Section A (Skills/Concepts Consolidation)

1. **(F2.3 - R) (CI)** The zeroes of an original function, $Q(x)$, are $x = $ -4, $x = 5$ and $x = 8$. Find the zeroes of the given functions: **(Cirrito 6.1, 6.2, p173 & p177)**
   a. $f(x) = Q(4x)$ b. $t(x) = Q(x - 3)$ c. $k(x) = Q(2x - 5)$ d. $j(x) = 3Q(x + 2)$

2. **(T.3.2, T3.3 - R) (CI)** Adam has mastered the "unit circle" and wants to apply this understanding to working through the following trig identities question: Given the fact that $\sin(x) = -\frac{3}{8}$ and $180° < x < 270°$, find each value: **(Oxford 13E, p460)**
   a. $\sin(2x)$ b. $\cos(2x)$ c. $\tan(2x)$ d. $\sin(90° - x)$

3. **(C6.2, C6.3 - N) (CI)** Determine the points of inflection and the intervals of concavity for the graph of $f(x) = 2x^4 - 4x^3$. **(Cirrito 20.3, p672)**

4. **(T3.1 - N) (CI)** The semi circle with center O is shown and has an area of exactly 24 cm². **(Cirrito 9.7.3, p311)**
   a. Show that the shaded area can be expressed as $\frac{240}{\pi} - \frac{24}{\pi}\sin\theta$.
   b. If $\theta = \frac{2\pi}{3}$, find the exact area of the shaded region.

5. **(SP5.7, SP5.8 - N) (CA)** Inspired by all you Season 2 athletes (swimmers and ballers) ⇒ The random variable, X, refers to an athlete's completion of a daily training program. We are told that X is binomially distributed, where the probability of a successful completion of the training program is 0.78. Mr. Rutherford randomly surveys 8 Season 2 athletes. **(Cirrito 16.1, p527 and Cirrito 16.3.4, p544)**
   a. Determine $P(X = 3)$ and explain what the outcome means.
   b. Determine $P(X > 2)$ and explain what the outcome means.
   c. Hence or otherwise, determine $P(X = 3 \mid X > 2)$

6. **(SP5.5 - R) (CI)** A bag contains 4 green marbles and 6 yellow marbles. Sam selects one marble from the bag and then **without** replacement, he selects a second marble. **(Oxford 3.5, p89)**

   a. Write down the probability that the first marble Sam selects is green.
   b. Find the probability that Sam selects two green marbles.
   c. Find the probability that Sam selects two marbles of different colour.

Section B (Skills/Concepts Practice)

7. **(SP5.8 - N) (CA)** Mr. Smith is playing a game, wherein he is tossing a biased coin. The probability of obtaining heads on this biased coin is ⅓ . **(Cirrito 16.3, p544)**

    a. He tosses the coin five times. Find the probability of getting
        i.   at least three heads;
        ii.   two heads and three tails.

    b. Mr. Dunham also plays the game and he now tosses the coin 12 times.
        i.   Find the expected number of heads.
        ii.   Mr. Dunham wins $ 10 for each head obtained, and loses $ 6 for each tail. Find his expected winnings.

8. **(C6.4 - N) (CA)** Use SYMBOLAB to help with the following investigation: Working the composite function $g(x) = e^{f(x)}$, find: **(Cirrito 19.3.6, p621)**

    a. The derivative of $y = e^x$
    b. The derivative of $y = e^{\frac{1}{2}x + 4}$
    c. The derivative of $y = e^{2x - 5}$
    d. The derivative of $y = e^{4x^2 + 5}$
    e. The derivative of $y = e^{3x^2 - 4x + 5}$
    f. The derivative of $y = e^{\sin(x)}$
    g. Make a general conclusion about the derivative of $g(x) = e^{f(x)}$

9. **(C6.3, C6.6 - N) (CI)** From the following velocity-time graph, answer the following questions:

    a. Find the speed of the bus at $t = 2$ s and at $t = 8$ s and at $t = 12$ s.
    b. Find the average rate of change of speed between $t = 2$ s and $t = 8$ s.
    c. Find the instantaneous rate of change of speed of the bus at $t = 2$ s, $t = 8$ s and $t = 12$ s.
    d. What is the rate of change of speed called?
    e. How far did the bus travel in the first 5 seconds?
    f. How far did the bus travel in the first 10 seconds?
    g. Find the average speed of the bus in the first 10 seconds.