Math SL PROBLEM SET 25

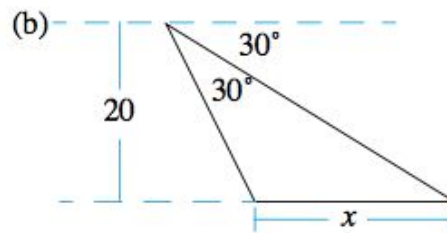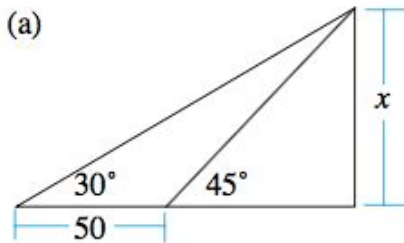**Section A (Short Answer)**

1. (**C6.1 - N**) (**CI**) For these functions, write an expression for the difference quotient $\frac{f(2+h)-f(2)}{h}$.
   (Cirrito 18.1.4, p583; Cirrito 18.3.1, p591, Oxford 7.2, p200)

        a. $f(x) = x^2 - 6$ b. $f(x) = 5 + x^3$

2. (**T3.6 - R**) (**CI**) Find the exact value of x in the following diagrams: *(Cirrito 9.1, p273; Oxford 13.1, p48)*

3. (**T3.2, T3.5 - E**) (**CI**) For the following trigonometric equations, start by (i) drawing the two special right triangles and (ii) drawing one cycle of a sine and a cosine curve and labeling the five critical points on each graph. *(Cirrito 10.4, p351)*
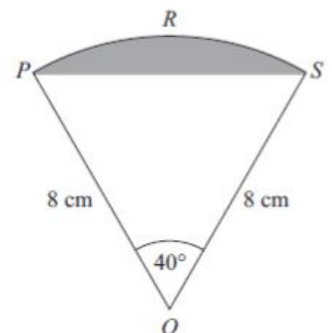
        a. Solve $\sqrt{2}\cos(x) - 1 = 0$ on the domain of $-2\pi \le x \le 2\pi$

        b. Solve $2\cos^2(x) - \cos(x) - 1 = 0$ on the domain of $0 \le x \le 720°$

4. (**T3.1 - N**) (**CA**) The diagram shows a sector of a circle with centre O. The radius of the circle is 8 cm. PRS is an arc of the circle. PS is a chord of the circle. Angle POS $= 40°$. Calculate the:

   (Cirrito 9.4, p 287; Cirrito 9.7, p309)

        a. perimeter of the sector

        b. area of the shaded section

5. (**F2.1, F2.4 - R**) (**CI**) For the following quadratic functions, (i) factor the equation and (ii) then hence or otherwise determine the minimum/maximum value of the quadratic function.

   (Cirrito 2.4.2, p44)

        a. $f(x) = 3x^2 + 11x - 4$

        b. $g(x) = -4x^2 + 9x - 2$

        c. For each quadratic function, predict the slope of the tangent line that can be drawn at the min/max point. Explain your reasoning.

6. (**T3.4 - R**) (**CI**) The number of empty bird nests in a park is approximated by the sinusoidal model $N(t) = 74 + 42sin\left(\frac{\pi}{12}t\right)$, where t is the number of hours after midnight.

   (Cirrito 10.5, p361)

   a. Determine the equation of the sinusoidal axis (axis of the curve) and explain its meaning in the context of this problem.
   b. Determine the period of the function.
   c. Given the domain of two days, determine the maximum and minimum number of empty bird nests and at what times these occur.
   d. At what times of the day is the number of bird nests equal to 95?
   e. Sketch a graph of the function, labeling the maximum(s) and minimum(s)

Section B (Extended Response/Investigation)

7. (**T3.2, T3.3 - N**) (**CI**) Determine the sine and cosine ratios of $\frac{\pi}{3}$, $\frac{3\pi}{4}$ and $-\frac{5\pi}{6}$. Use these ratios to determine the value of: *(Cirrito 10.1.2, p316; Cirrito 10.2.1, p327; Cirrito 10.2.2, p332)*

   a. the expression $\sin^2(x) + \cos^2(x)$ for $x = \frac{\pi}{3}$ and $x = \frac{3\pi}{4}$ and $x = -\frac{5\pi}{6}$.
   b. the expression $\frac{sin(x)}{cos(x)}$ for $x = \frac{\pi}{3}, \frac{3\pi}{4}$ and $-\frac{5\pi}{6}$ and compare to the value of $\tan(x)$ for the same angles of $x = \frac{\pi}{3}, \frac{3\pi}{4}, -\frac{5\pi}{6}$

8. (**A1.2 - E**) (**CI**) To find the solutions for the following equations, the use of logarithms is required, either in isolating exponents or in requiring the use of the laws of logarithms.

   (Cirrito 7.4, p219)

   a. Solve $2 = e^{0.075x}$
   b. Solve $3^{x-4} = 24$
   c. $\log_3(2x - 5) = 2$
   d. $\log_2(x) + \log_2(10 - x) = 4$
   e. $\ln(x - 2) + \ln(2x - 3) = 2\ln(x)$