Math SL PROBLEM SET 9

Section A (Short Answer)

1. (**A1.3 - E**) **(CI)** I have a collection of four boxes each holding two balls, one marked with an x and one marked with the number 1. I choose exactly one ball from each box. ***(Cirrito 14.2, p498)***

   a. In how many ways can I choose two xs and two ones from the four boxes?
   b. What is the coefficient of x^2 in the expansion of $(x + 1)(x + 1)(x + 1)(x + 1)$?

2. (**A1.1 - N**) **(CA)** On September 1st, my cat eats three "Lucky Lynx" treats. On the next day, she eats seven, and on each day throughout September the number of treats she eats increases by the same amount. ***(Cirrito, 8.1.2, p245)***

   a. How many snacks did my cat eat on the tenth day?
   b. On what day does she eat the 1121st treat?

3. (**F2.7 - R**) **(CI)** By considering the discriminant, or otherwise, find the value(s) of k for which the following equation $x^2 - 10x + k = 0$ has two distinct real roots. ***(Cirrito 2.4.1, p39)***

4. (**F2.7 - R**) **(CI)** For what value(s) of c does the parabola $y = x^2 + 6x + 2$ meet the line $y = 2x + c$ in exactly two places? ***(Cirrito 2.4.1, p39)***

5. (**A1.2 - R**) **(CI)** Use your knowledge of exponent laws to simplify the following expressions: ***(Cirrito 7.1.1, p197)***

   a. $\left(\frac{3y^2}{4x^3}\right)^3 \times (2x^2y^3)^3$ b. $\frac{9^n \times 3^{n+2}}{27^n}$ c. $\frac{4^{n+2} - 16}{4}$

6. (**A1.1 - N**) **(CA)** On my first birthday, my Grandmother put \$5 into a savings account for me. On my second birthday, she put \$15 into the same account, increasing the amount she deposited by \$10 every year up to and including my 18th birthday. How much did she deposit in total over my first eighteen years? ***(Cirrito, 8.1.2, p245)***

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Section B (Extended Response/Investigation)

7. **(C6.1 - N) (CA)** Drag car C is moving along a straight track. At time t seconds it has travelled a distance x_c metres, where $x_c = t^2 + 2t$. ***(Cirrito 18.1.2, p582)***

   a. Find the average speed of the car in the interval $3 \leq t \leq 4$.

   b. Find the car's average speed in the following intervals:

      i. $2 \leq t \leq 3$;

      ii. $2 \leq t \leq 2.5$;

      iii. $2 \leq t \leq 2.1$;

      iv. $2 \leq t \leq 2.01$.

   Each of these speeds is the average speed across an interval, but at any time the car's speedometer will read an instantaneous speed.

   c. What will be the car's instantaneous speed when t = 2?

8. (**T3.2 - E**) **(CA)** A wheel of radius 1 m has a single point marked on its circumference with a blob of red paint. Initially, the blob is level with the wheel's axle and the wheel is turned so that the blob rises. ***(Cirrito, 10.3, p336)***

   a. Use your calculator to determine height of the blob above the axle height after the wheel has rotated through an angle of: 15°, 30°, 45°, 60°, 75°, 90°.

   b. Without using your calculator, find the height of the blob above the axle height after the wheel has been rotated by 105°, 120°, 135°, 150°, 165°, 180°, 195°, 210°, 225°, 240°, 255°, 270°, 285°, 300°, 315°, 330°, 345°, 360°.