

Math SL PROBLEM SET 78

Section A (Short Answer)

1. **(CA6.2 - R) (CI)** Given the following functions, find their derivatives:

a. $f(x) = \ln(x^2 + 4x - 2)$

b. $g(x) = 3x\cos(5x^3)$

c. $h(x) = \frac{3x^4}{e^{4x}}$

2. **(CA6.4 - R) (CA)** Evaluate the following integrals:

a. $\int_2^6 e^{\frac{x}{2}+2} dx$

b. $\int_e^{e^2} \frac{2}{3x} dx$

c. $\int_{\frac{3\pi}{4}}^{\pi} (1 - \sin(2x)) dx$

3. **(CA6.6 - R) (CI)** The velocity, v , in ms^{-1} of a particle moving in a straight line is given by the function $v(t) = t^2 - 11t + 24$, where t is time in seconds.

- If $s(0) = 2$, find the equation for the position function, $s(t)$.
- Find the displacement of the particle in the first six seconds of travel.
- Find the total distance travelled in the first six seconds of travel.

4. **(CA6.6 - R) (CI)** The velocity, v , in ms^{-1} of a particle moving in a straight line is given by the function $v(t) = \sin(2t + \pi)$, where t is time in seconds.

- If $s(0) = 2$, find the equation for the position function, $s(t)$.
- Find the displacement of the particle in the first π seconds of travel. Explain the significance of your result.

5. **(SP5.6 - R) (CI)** Two independent events, A and B are given such that $P(A) = 0.40$, $P(B) = 0.50$ and $P(A|B) = 0.60$.

- Find $P(A \text{ and } B)$
- Are events A and B mutually exclusive? Give reasons for your answer.
- Are events A and B independent? Give reasons for your answer.
- Find $P(A \text{ or } B)$
- Find $P(B|A)$

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6. **(SP5.6 - R) (CI)** Two independent events, A and B are given such that $P(A) = k$, $P(B) = k + 0.3$ and $P(A \cap B) = 0.18$.
- Find the value of k .
 - Find $P(A \cup B)$
 - Find $P(A' | B')$
7. **(SP5.9 - R) (CA)** The time taken for a student to complete an exam is normally distributed with a mean of 40 minutes and a standard deviation of 5.5 minutes.
- A student is selected at random. How probable is it that the student completes the exam in less than 47 minutes?
 - Six students are selected at random. How probable is that at least 4 of them finished the exam in less than 47 minutes?
 - The probability that a student takes between q and 47 minutes is 0.4. Find the value of q .
8. **(SP5.9 - R) (CA)** The weights, W , of tea bags are normally distributed. If 7% of the bags weigh less than 3.75 g and 12% of the bags weigh more than 4.05 grams, find how many weigh more than 3.95 g.
9. **(V4.2, V4.4 - R) (CI)** ABCD is a rectangle such that A (2, -1, 4), B(6,5,2) and C(2,8,3).
- Find the coordinates of point D.
 - Find the cosine ratio of the acute angle between the diagonals of the rectangle
10. **(V4.2, V4.3 - R) (CI)** A line, L_1 , passes through the points A(2,1,-1) and B(5,-5,-4).
- Show that $\overrightarrow{AB} = 3i - 6j - 3k$.
 - Write down a vector equation for L_1 in the form of $r = a + tb$.
- $$r = \begin{pmatrix} 5 \\ 5 \\ 1 \end{pmatrix} + s \begin{pmatrix} -3 \\ 4 \\ 2 \end{pmatrix}$$
- The line L_2 has the vector equation
- Determine the intersection point of L_1 and L_2 .