

Math SL PROBLEM SET 43

Section A (Skills/Concepts Consolidation)

1. **(CA6.1 - N) (CI)** Find the equations of derivatives of the following functions:

(Cirrito 19.1, p608)

- a. i. $g(x) = x^3 + 2x^2 - 15x - 13$ ii. $h(x) = (2x - 7)^2$
b. i. $k(x) = \sqrt{x} - 6$ ii. $m(x) = \frac{x^4}{4} + \frac{3x^3}{2} - 2x^2$

2. **(CA6.1 - N) (CI)** Determine the equations of the lines that are (i) tangent to and (ii) normal to the following functions at the specified points:

(Cirrito 20.1, p646)

- a. $y = 3x^2 - 4x$ at the point (1,-1).
b. $y = 1 - 6x - x^2$ at the point (-3,10).
c. $y = (x + 2)(x - 6)$ at the point (3,15).

3. **(CA6.1 - N) (CI)** The function $y = x^2 + 3x$ has a tangent line drawn at $x = a$ where the tangent slope is 5. Find the value of a .

(Cirrito 20.1, p646)

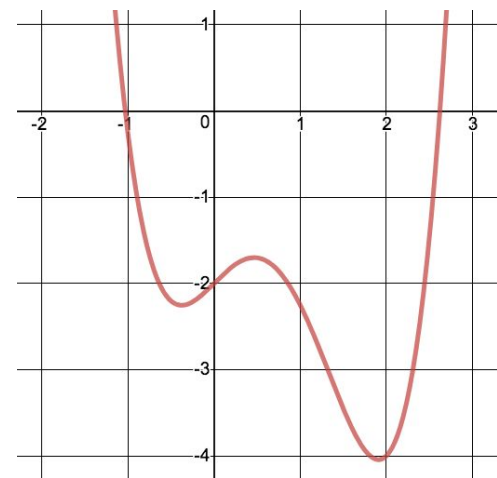
4. **(CA6.3 - N) (CI)** Here is a graph of a function. Draw graphs of the first and second derivatives of this function.

(Cirrito 19.2, p609)

5. **(CA6.3 - N) (CI)** For the function $f(x) = x^4 - 2x^3$, determine:

(Cirrito 20.2, p649)

- a. the equation of the derivative of $f(x)$.
b. the zeroes of f' .
c. Hence or otherwise, find the coordinates of the **stationary points** of f .
d. Hence or otherwise, find the **intervals of increase and decrease** of f .
e. Sketch a graph of f . Then use your calculator and graph f and compare.



6. **(CA6.3 - N) (CI)** For the function $f(x) = x^4 - 4x^3$, determine:

(Cirrito 20.2, p649)

- a. the equation of the second derivative of $f(x)$,
b. the zeroes of f'' .
c. Hence or otherwise, find the coordinates of the **inflection points** of f .
d. Hence or otherwise, find the **intervals of concavity** of f .
e. Sketch a graph of f . Then use your calculator and graph f and then compare.

Math SL PROBLEM SET 43

Section B (Skills/Concepts Practice)

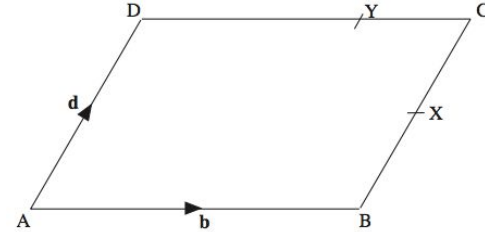
7. **(V4.3 - N) (CA)** The lines L_1 and L_2 have the following equations: **(Cirrito 12.6.1, p432)**

$$L_1: x = 1 + 2t, y = 3 - 4t, z = -2 + 4t$$

$$L_2: x = 4 + 3s, y = 4 + s, z = -4 - 2s$$

- a. Show that the lines intersect at $(1, 3, -2)$
- b. Find the angle between the lines at their intersection.

8. **(V4.1 - N) (CI)** In the parallelogram shown, $\vec{AB} = b$ and $\vec{AD} = d$. Also, X is the midpoint of BC and Y lies on DC such that $DY = 2CY$. Express the following vectors in terms of b and d:



- | | | |
|----------------|----------------|----------------|
| (a) \vec{AC} | (b) \vec{BX} | (c) \vec{AX} |
| (d) \vec{DY} | (e) \vec{AY} | (f) \vec{XY} |

(Cirrito 12.3, p421)

9. **(SP5.6, SP5.7 - R,N) (CA)** Here are the results of a survey on hours of homework done over the weekend by IB year 1 students. Students were asked to round their studying time to the nearest hour.

(Cirrito 16.1, p527)

Number of hours studied	0	1	2	3	4	5
Number of students	4	12	8	3	2	1
Relative frequency				0.10		

- a. Explain why this data table shows an example of a **discrete** data set
- b. Find the mean and standard deviation of the number of hours studied.
- c. Prepare a frequency histogram of the results.
- d. How probable is it that a randomly selected student studied 2 hours?
- e. How probable is it that a randomly selected student studied at most 3 hours?
- f. How probable is it that a randomly selected student studied either 2 or 3 hours?
- g. Complete the row wherein you calculate the relative frequencies.
- h. We will now define the variable X as the number of hours studied. Determine:
 - i. $P(X = 3)$
 - ii. $P(X \geq 3)$
 - iii. $P(X = 3 | X \geq 3)$
 - iv. $P(2 \leq X \leq 4)$