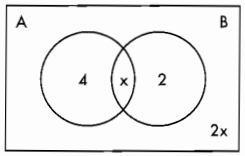
**Question 9** [1 + 3 = 4 marks]

Given the following Venn diagram showing events A and B




Determine x if:

(a) A and B are mutually exclusive.

(b) A and B are independent.






**SECTION ONE: CALCULATOR-FREE** **40 Marks**

This section has **NINE (9)** questions. Attempt **all** questions

**Question 1** [3 marks]

Simplify the following:

$$\frac{2a^3 - 7a^2 - 4a}{2a^2 - 5a - 3} \times \frac{6a - 18}{16 - a^2}$$

**Question 2** [1 + 1 + 2 = 4 marks]

Differentiate the following without simplifying:

(a) $y = \pi - x^3 + e^4$

(b) $y = e^{4x - 3x^2}$

(c) $y = \sqrt{4x^2 + 2x - 3}$

**Question 3** [2 + 2 + 2 = 6 marks]

Given $f(x) = x^2 + 6$
$g(x) = \sqrt{x - 4}$
$h(x) = x^2 (x - 1)$

find:

(a) f o g(x) expressing your answer in a simplified form.

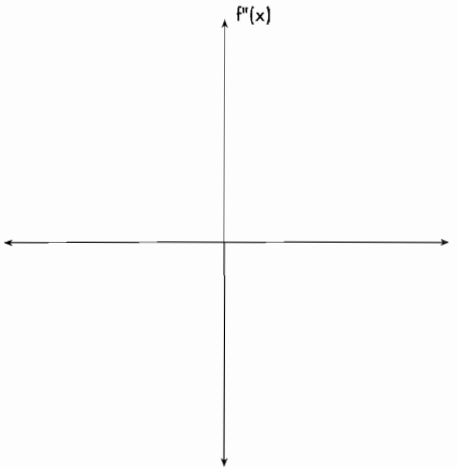
(b) the domain and range of f o g(x).

(c) the value(s) of x where g o h(x) exists.






(b)




**Question 8** [4 + 2 = 6 marks]

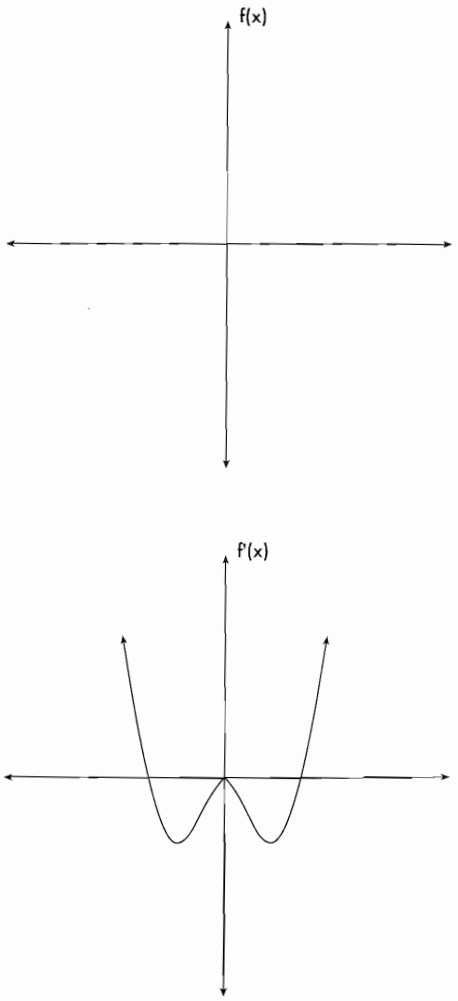
(a) Determine all turning points, their nature and points of inflection for the function $f(x) = x^3 - 3x^2$.

(b) Find the maximum and minimum values of the function $f(x) = x^3 - 3x^2$ over the interval $-2 \leq x \leq 1$

**Question 7** [3 + 2 = 5 marks]

Sketch possible graphs of f(x) and f''(x) on the axes provided below given the graph of the derivative function f'(x).

(a)









**Question 4** [1 +1 + 2 = 4 marks]

Determine the following integrals:

(a) $\int \frac{2}{\sqrt{x}} - \sqrt[3]{x}\ dx$

(b) $\int_0^2 3(x + e^{3x})\ dx$

(c) $\int \frac{x^3 - 1}{(x^4 - 4x)^3}\ dx$

**Question 5** [5 marks]

A shopkeeper imports three varieties of fruit to sell in her shop The three varieties of fruit were apples, oranges and bananas The weight of apples was four kilograms less than eight times the weight of the oranges The weight of apples was three times the total weight of the bananas and oranges.

If the latest order of fruit was 80 kg, determine by setting up a system of equations how many kilograms of oranges were ordered





**Question 6** [3 marks]

After investigating the addition of integers, Simon makes a conjecture that: 'The sum of two odd integers is even'

Is Simon correct? Prove using algebra.