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SECTION A

QUESTION 1

(a) Solve for x in each of the following equations. Showing all working detail.

(1) $-5x^2 + 2x + 2 = 0$ (Leave in simplest surd form) (3)

(2) $x^2 - 8x - 4 < -20$ (3)

(3) $\log_5(x^2 + 1) - 2 \log_5 x = 1$ (5)

(b) Solve for x and y in the equations below.

(6)

$$3^{x+3} = 9^{-y}$$

$$2x^2 + xy - y^2 = 0$$

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QUESTION 2

- (a) Gisele's parents bought her a motorbike worth R89 900 for her 18th birthday. The value of the motorbike depreciates at a rate of 12,66% p.a. on the reducing balance method. Determine the value of the motorbike after 3 years. (2)
- (b) Christine wants to buy a car in five year's time. She opens an investment account and decides to save up for the deposit of the car.
- (1) Convert a nominal rate of 13,4% p.a. compounded weekly to an effective quarterly rate. Round your answer off to three decimal places. (3)
- (2) Hence, if Christine decides to save R2 250 at the end every quarter, starting immediately, determine how much she will have saved up for the deposit of the car at the end of the 5th year. (4)

QUESTION 3

Zinathi planted a lemon tree in her garden. The total number of lemons on the tree at the end of each week is given by the **quadratic sequence** below.

$$2; x + 3; 2x + 8; 35; \dots; 405$$

(a) Show that $x = 6$. (5)

(b) Determine the general formula for the total number lemons on week n . (4)

- (c) If the total number of lemons that grow on the tree is 405, calculate the number of weeks the lemons grew on the tree. (4)

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QUESTION 4

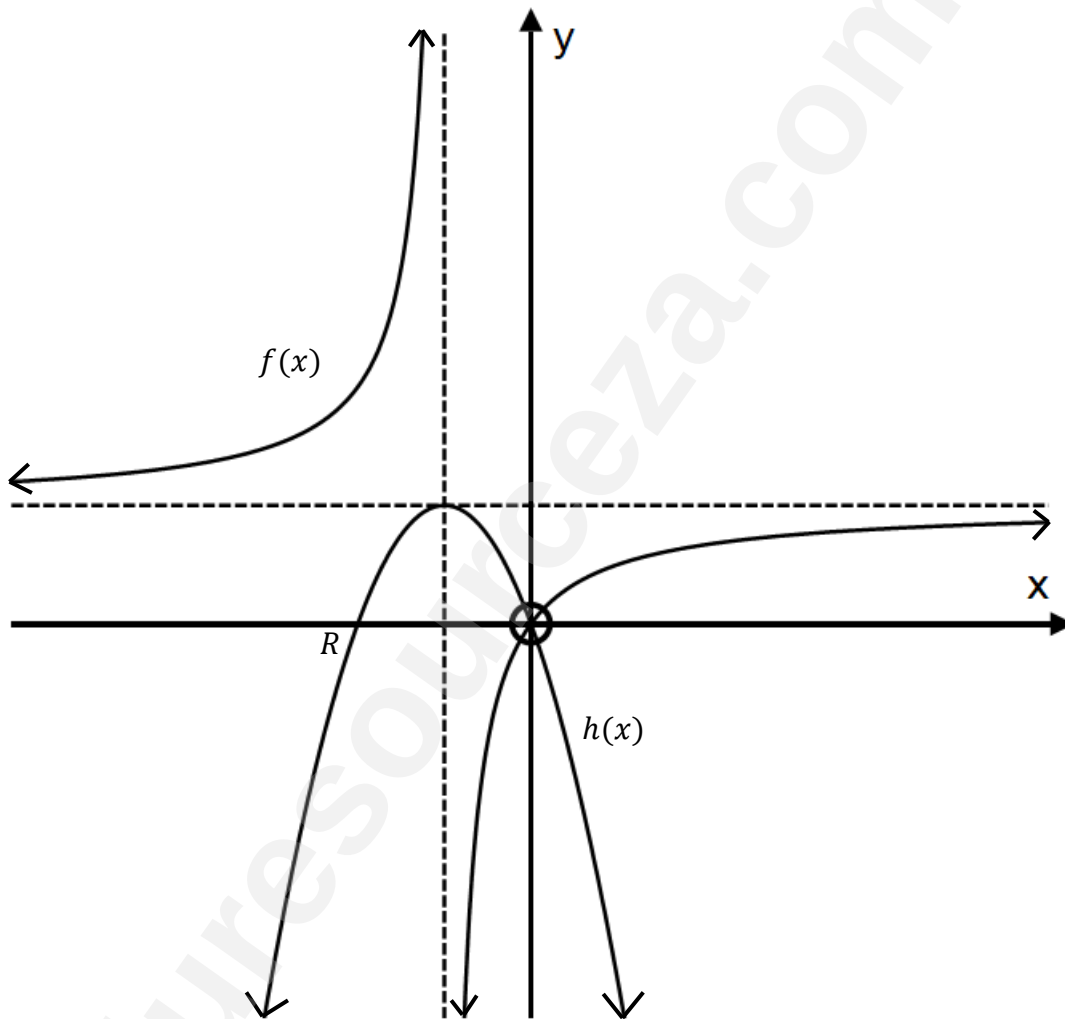
- (a) Determine $f'(x)$ using first principles if $f(x) = 3x^2 + 5$. (5)

(b) Determine $D_x \left[(-\sqrt{x} + 4) \left(\frac{1}{\sqrt{x}} - 3\sqrt{x} \right) \right]$ (4)

(c) Given $3xy - 11x = 12x^2 + y - 5$. Determine $\frac{dy}{dx}$. (5)

QUESTION 5

Consider the diagram given. $f(x) = \frac{-3}{x-p} + q$ and $h(x) = -3(x-p)^2 + 3$ both pass through the point $(0;0)$. $y = -x + 2$ is one of the axes of symmetry for the graph of $f(x)$.



(a) Write down the range of $h(x)$.

(1)

(b) Find the values of p and q . (3)

(c) Calculate the distance RO. (3)

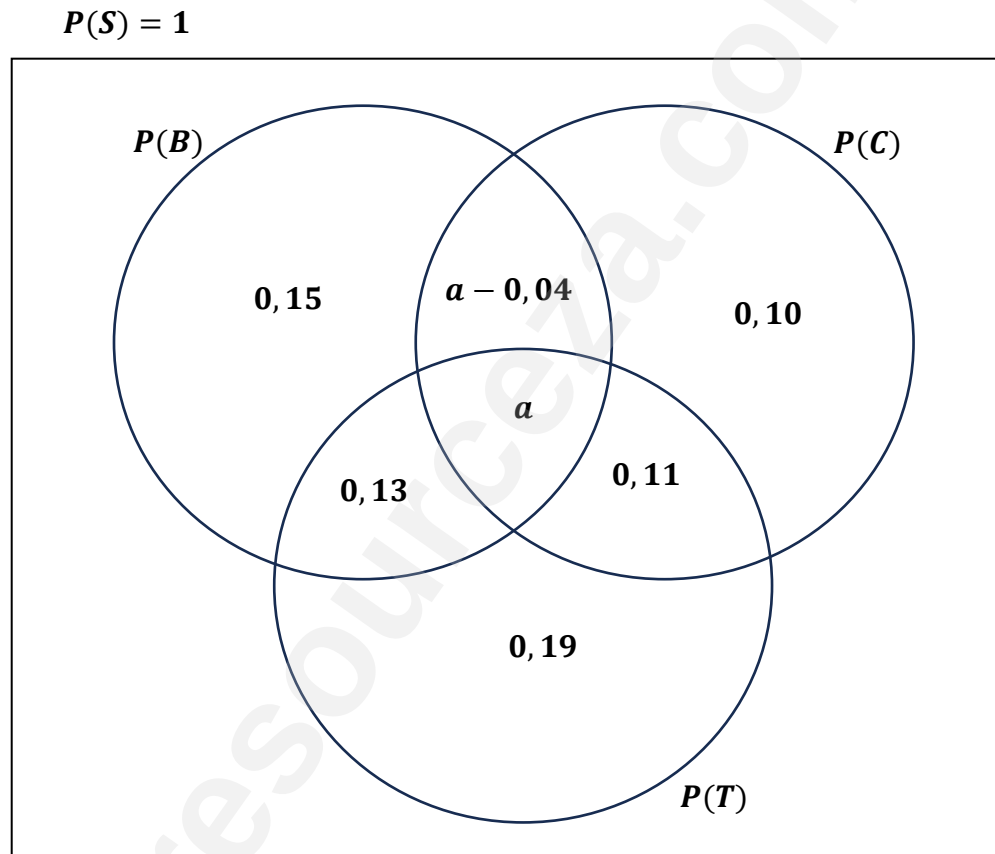
(d) Write down the equation of the graph of $g(x)$ which is a reflection of $f(x)$ about the y -axis in the form $g(x) = \frac{k}{x-p} + q$. (2)

(e) Determine the value(s) of x for which $f'(x) \cdot f(x) > 0$. (2)

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QUESTION 6

Hannah wants to decide on which dessert to sell at a bake sale. She conducts a survey to see if students prefer brownies (B), chocolate (C) or tiramisu (T). The Venn diagram below shows the probability of a student selected at random liking different desserts.



Determine:

- (a) the value of a if the probability of enjoying at least 2 desserts is 0,54. (3)

(b) the probability of liking brownies or tiramisu. (2)

(c) whether liking brownies is independent of liking chocolate. Show all working detail. (5)

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TOTAL SECTION A: 74 MARKS

SECTION B

QUESTION 7

Emma wants to buy shares in H&M. She checks the share price at 17:00 on the 1st day of each month starting on the 1st of January 2023. She realises that the share price follows a **geometric sequence**. The sequence in the share prices has the following properties.

- $T_2 = 120$
- $2T_3 + 2T_4 = \frac{800}{3}$

- (a) Determine the constant ratio, $r > 0$, and hence the general formula representing the share price on the 1st day of the n^{th} month. (7)

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- (b) Determine in which month the share price will be below R5 for the first time.

Show all working.

(3)

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QUESTION 8

Sinead has 7 water bottles of which two are identical blue bottles and the rest are each a different colour.

- (a) Calculate the number of ways she can arrange the bottles on a shelf. (3)

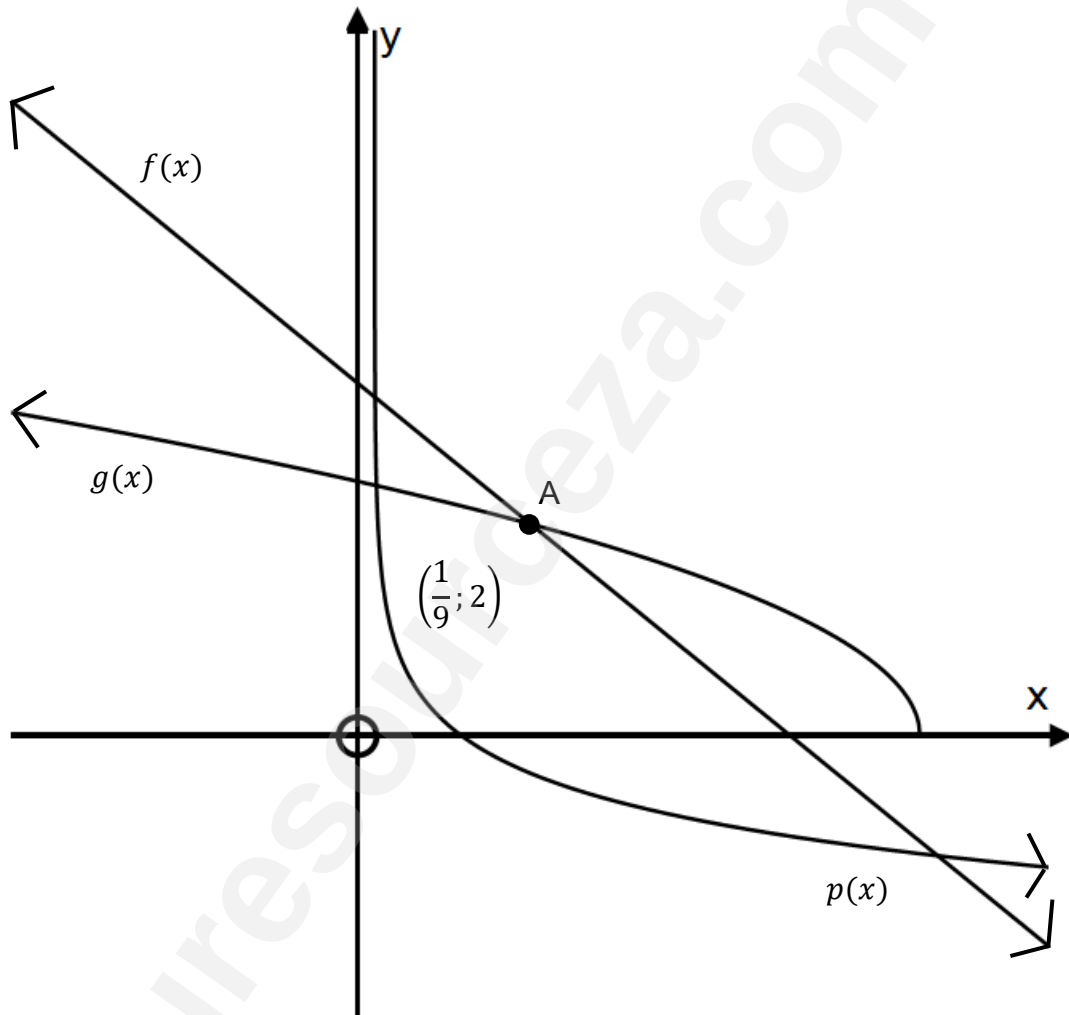
- (b) Determine the **probability** that the red and orange bottle are next to each other.

(4)

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QUESTION 9

Consider the diagram. The graphs of $f(x) = -x + 5$, $g(x) = \sqrt{13 - 2x}$ and $p(x) = \log_b x$, $x > 0$ are sketched. Point A is the point where the graphs of $f(x)$ and $g(x)$ intersect. The point $(\frac{1}{9}; 2)$ lies on the graph of $p(x)$.



Determine:

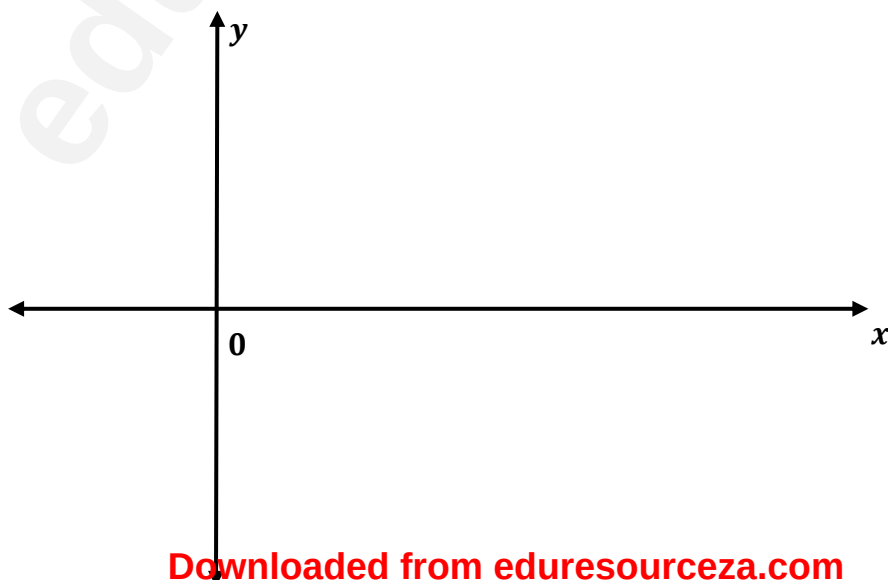
- (a) the domain of the graph of $g(x)$. (2)

(b) the equation of $p(x)$. (3)

(c) the equation of $h(x)$ if $h(x) = p^{-1}(x) + 4$. (2)

(d) the co-ordinates of point A. (4)

(e) On the axes provided draw a rough sketch of $g^{-1}(x)$ showing the intercepts with the axes. (4)



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QUESTION 10

Mr. John decides to take out a loan to buy a set of couches that he saw at the UFO store. He can pay back the loan by means of equal monthly payments of R780,99 over a period of 4 years. The interest rate charged is 15,6% p.a. compounded monthly.

- (a) The outstanding balance on the loan at the end of 2 years is R14800.
Calculate the amount he took out on loan to purchase the couches. (5)
- (b) Calculate the total interest paid on the loan at the end of the second year. (4)

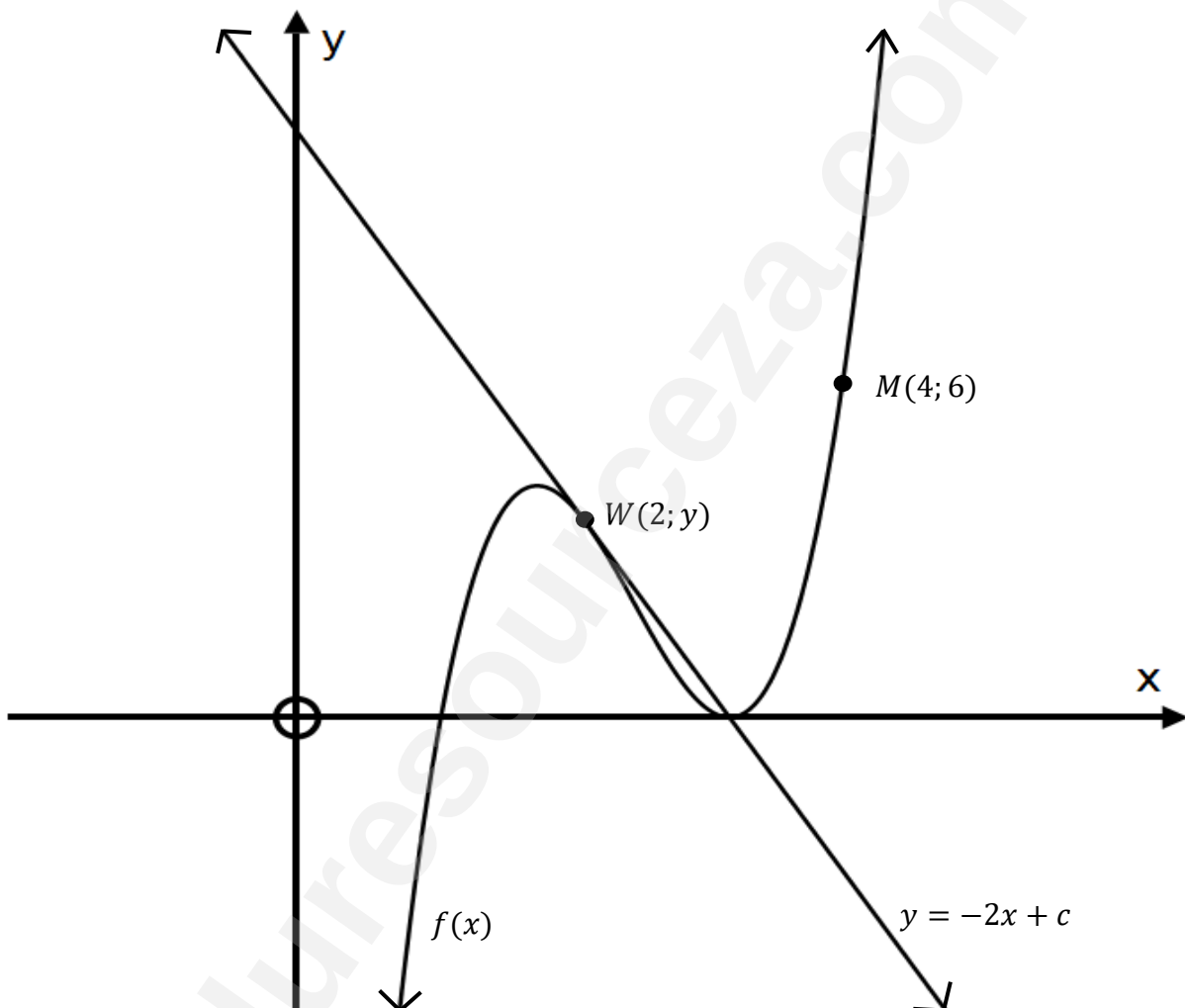
- (c) Mr John has financial troubles after his payment at the end of the second year. He cannot make his monthly payments for the next three months. If he wishes to still pay off the loan at the end of 4 years, calculate his new monthly payments if he starts making payments 4 months into the third year. (5)

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QUESTION 11

- (a) A graph of a cubic function $f(x) = ax^3 - 14x^2 + bx - 18$ is drawn on the axes below. The point $M(4; 6)$ lies on the graph of $f(x)$ and $y = -2x + c$ is a tangent to the curve at the point $W(2; y)$.



(1) Show that $a = 2$ and $b = 30$.

(6)

(2) Determine the values of x where the tangent is a horizontal line. (4)

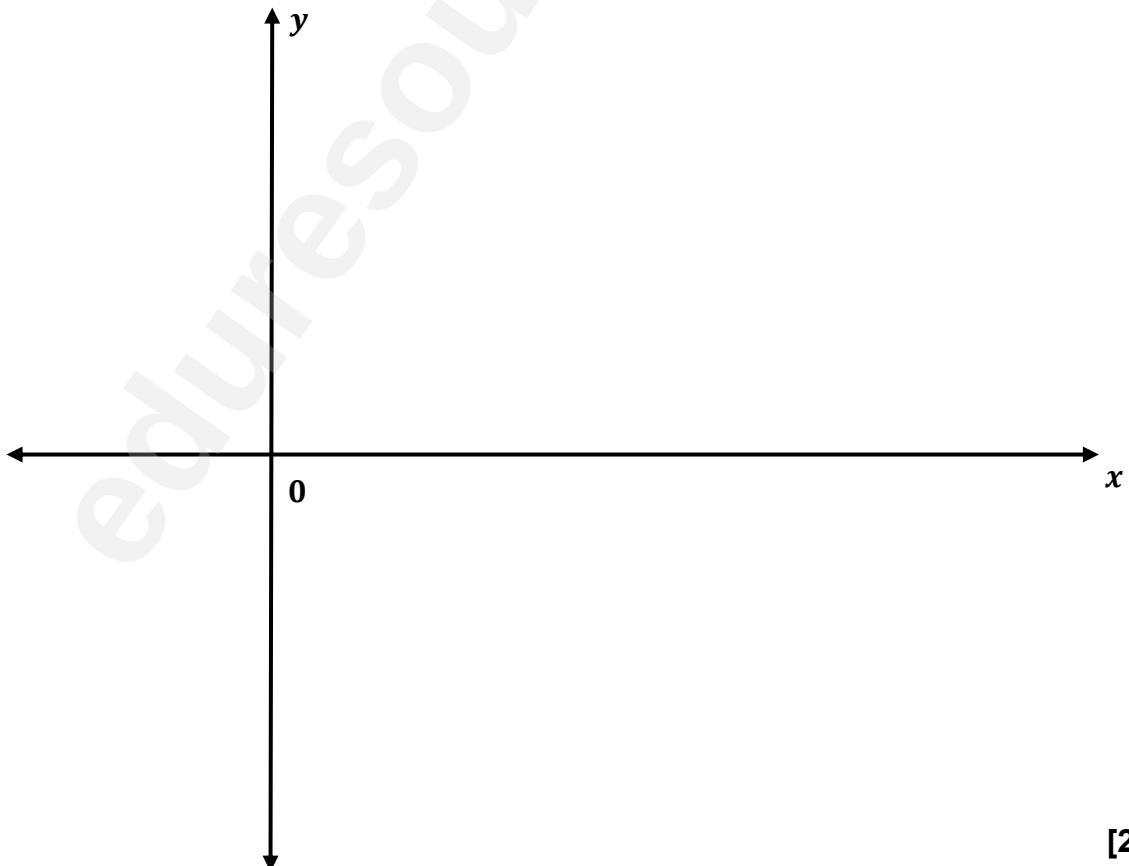
(3) Determine the value(s) of k for which $f(x) = k$ will have one root. (3)

(b) $h(x)$ is a cubic function with the following properties.

- $h(1) = 0$
- $h'(1) = h'(7) = 0$
- $h(0) = 9$
- $h''(7) < 0$ and $h''(1) \neq 0$

(1) Determine the value of c such that $h''(c) = 0$ and $h'(c) \neq 0$. (2)

(2) On the axes provided draw a rough sketch of $h(x)$ indicating the y intercept and the x co-ordinates of the turning points and points of inflection. (5)



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QUESTION 12

The diagram below shows a solid right circular cone that is set centrally within a hemispherical container. The radius of the hemisphere is $5\sqrt{6}$ cm. The radius of the cone is r cm. Of all possible right circular cones that can fit into the hemisphere, calculate, showing all working:



$$V = \frac{4}{3}\pi r^3$$

$$V = \frac{1}{3}\pi r^2 H$$

- (a) the value of x (height of the cone in cm) for which the cone will have a maximum volume. Leave your answer in surd form. (7)

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- (b) the maximum volume of the cone to two decimal places. (3)

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TOTAL SECTION B: 76 MARKS

TOTAL MARKS: 150 MARKS

EXTRA WORKING SPACE

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