

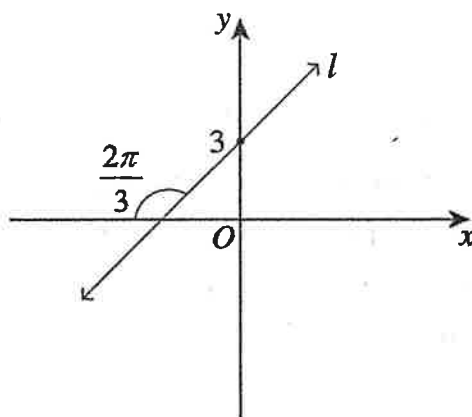
Name: _____

Year 12 Advanced Half Yearly MOCK Exam

Section 1 – 10 Multiple Choice

Circle the correct answer.

1. Line l is shown in the graph.



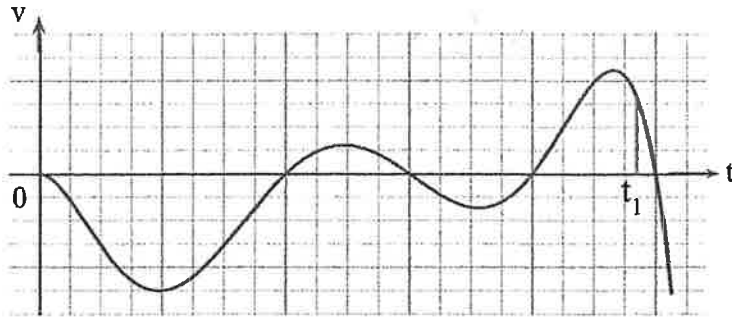
What is the gradient of line l ?

- A. $-\frac{1}{\sqrt{3}}$
B. $-\sqrt{3}$
C. $\frac{1}{\sqrt{3}}$
D. $\sqrt{3}$
2. What are the solution(s) to $|2x - 1| = 5$?
- A. $x = -2$
B. $x = 3$
C. $x = -2$ and $x = 3$
D. $x = -3$ and $x = 2$

3. Which of the following is the derivative of $y = \ln \sqrt{\frac{x+1}{x-1}}$?

- A. $\frac{dy}{dx} = \frac{1}{2} \left(\frac{x+1}{x-1} \right)$
B. $\frac{dy}{dx} = \frac{1}{2} \left(\frac{1}{x+1} - \frac{1}{x-1} \right)$
C. $\frac{dy}{dx} = 2 \left(\frac{1}{x+1} - \frac{1}{x-1} \right)$
D. $\frac{dy}{dx} = \frac{1}{2} (\ln(x+1) - \ln(x-1))$

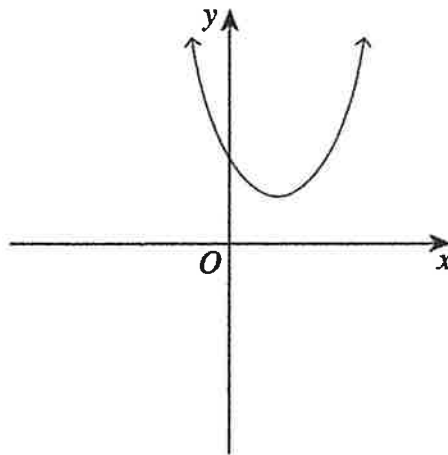
4. The graph shows the velocity of a particle that starts to move from the origin along the t axis.



Which statement describes the motion of the particle at the point where $t = t_1$?

- A) The displacement is positive and the acceleration is negative.
- B) The displacement is negative and the acceleration is positive.
- C) The displacement is positive and the acceleration is positive.
- D) The displacement is negative and the acceleration is negative.

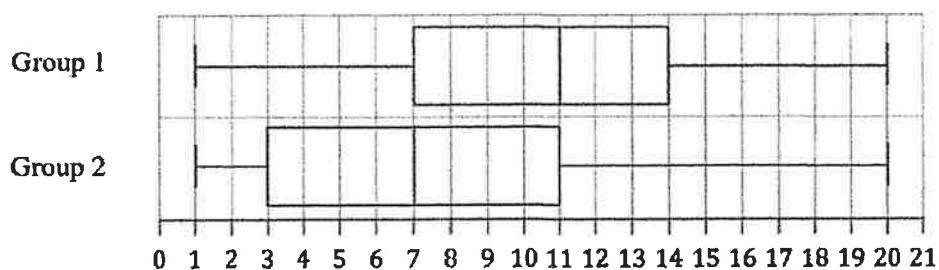
5. The graph shows the quadratic function $y = ax^2 + bx + c$.



Which of the following statements is correct?

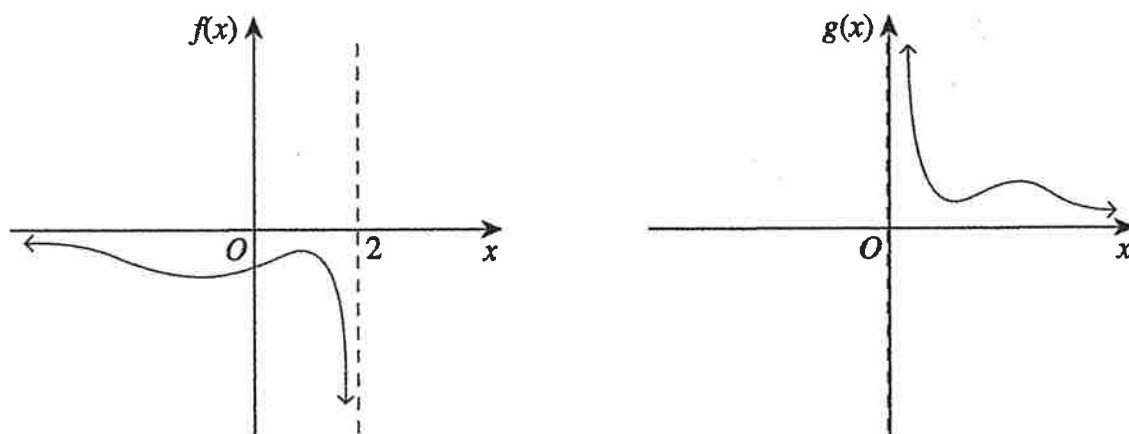
- A. $a > 0, c > 0$ and $b^2 - 4ac = 0$
- B. $a > 0, c > 0$ and $b^2 - 4ac > 0$
- C. $a > 0, c < 0$ and $b^2 - 4ac < 0$
- D. $a > 0, c > 0$ and $b^2 - 4ac < 0$

6. Consider the parallel box plots below.



Which of the following statements is CORRECT?

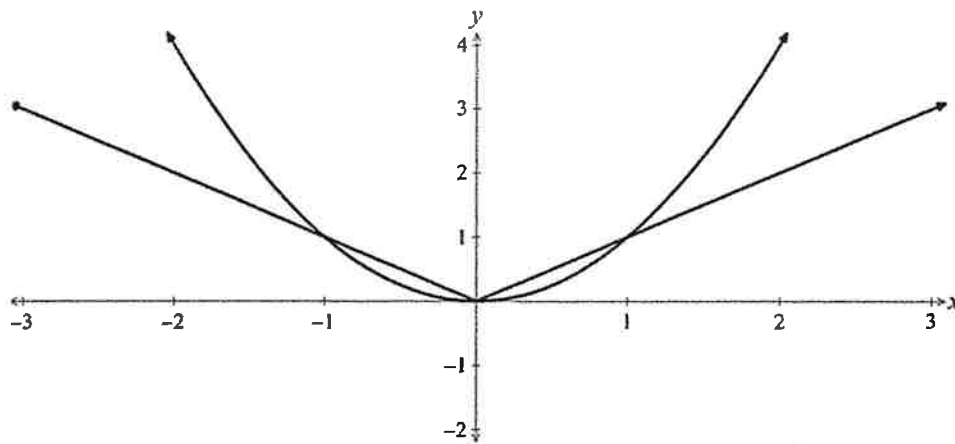
- A. Group 1 is positively skewed.
 - B. Group 2 is negatively skewed.
 - C. The difference between the median and Q_1 of Group 1 is the same as the difference between the median and Q_3 of Group 2.
 - D. The range and IQR are equal for both sets of data.
7. The function $y = f(x)$ is transformed to $y = g(x)$, as shown in the diagram.



Which of the following equations best represents the transformed function?

- A. $g(x) = -f(2 - x)$
- B. $g(x) = -f(x - 2)$
- C. $g(x) = f(2 - x)$
- D. $g(x) = f(x - 2)$

8. The graph shows $y = x^2$ and $y = |x|$.



What is the solution to the inequality $x^2 - |x| > 0$?

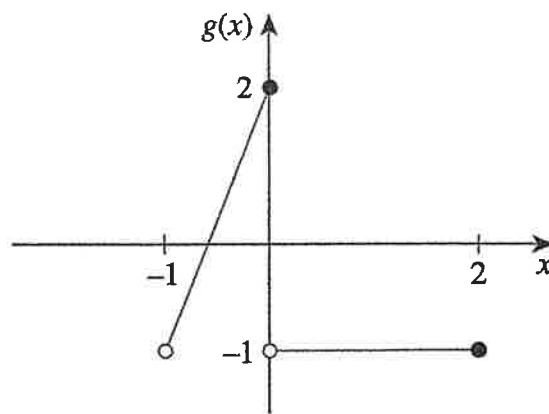
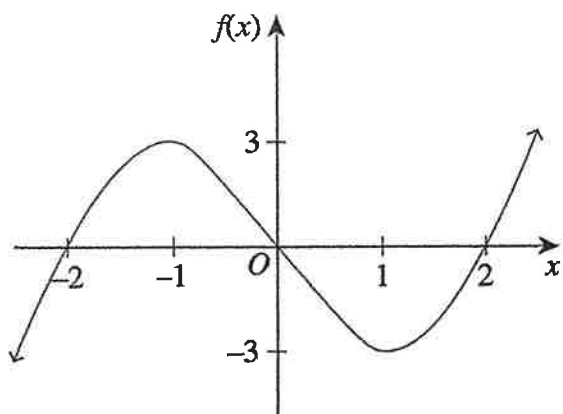
- A. $\{x: (-\infty, -1) \cup (1, \infty)\}$
 - B. $\{x: (-\infty, -1] \cup [1, \infty)\}$
 - C. $\{x: (-1, 1)\}$
 - D. $\{x: [-1, 1]\}$
9. Consider the information about events A and B .

- $P(B) = 0.6$
- $P(A | B) = 0.4$
- $P(A | \bar{B}) = 0.8$

What is the value of $P(B | A)$?

- A. $\frac{1}{5}$
- B. $\frac{2}{5}$
- C. $\frac{3}{7}$
- D. $\frac{4}{5}$

10. The graphs of $y = f(x)$ and $y = g(x)$ are shown.



What is the domain and range for $y = f(g(x))$?

	<i>Domain</i>	<i>Range</i>
A.	$(-1, 2]$	$[-3, 3]$
B.	$(-1, 2]$	$(-1, 2]$
C.	$(-\infty, \infty)$	$[-3, 3)$
D.	$(-\infty, \infty)$	$(-1, 2]$

End of Section 1

Section 2 – 60 Marks

Show your working in the space provided.

11. Solve $9^{2x-3} = 27^x$.

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[illegible]

12. A triangular park is shown below.

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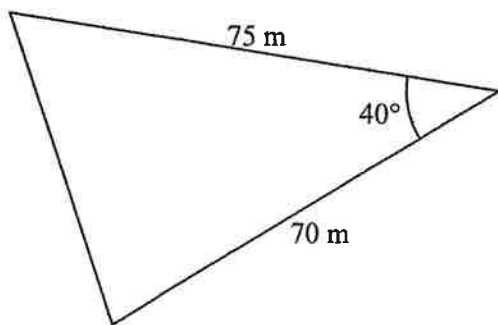


DIAGRAM
NOT TO
SCALE

Calculate the length of the unknown side, correct to the nearest metre.

[illegible]

13. Solve the equation $2\ln(x+2) - \ln x = \ln(2x+1)$ where $x > 0$, for x .

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[https://www.youtube.com/watch?v=U8DQW0Tgk6E](#)

14. Differentiate with respect to x :

(a) $x \sin^2 x$

2

1. The first step in the process of creating a new product is to identify a market need. This involves conducting market research to determine what consumers want and need. Once a need is identified, the next step is to develop a concept for a product that meets that need. This is often done through brainstorming and sketching. The third step is to create a prototype of the product. This can be done using various materials and techniques, depending on the product. The fourth step is to test the prototype with a small group of consumers to get feedback. Finally, the product is refined based on the feedback and then launched into the market.

(b) $\ln \sqrt{4x^2 - 1}$

2

1. The first step in the process of identifying a problem is to recognize that a problem exists. This involves gathering information about the situation and identifying the specific issue that needs to be addressed. Once the problem is identified, the next step is to define the problem in clear, concise terms. This involves identifying the goals and objectives of the project and determining the scope of the problem. The third step is to analyze the problem and identify the causes and effects. This involves gathering data and information about the problem and analyzing it to determine the underlying causes and the potential consequences of the problem. The fourth step is to develop a plan of action to address the problem. This involves identifying the resources needed to solve the problem and determining the steps that need to be taken to implement the plan. The fifth step is to implement the plan and monitor the progress. This involves putting the plan into action and tracking the progress of the project to ensure that it is on track and meeting the goals and objectives. The final step is to evaluate the results and make adjustments as needed. This involves reviewing the outcomes of the project and determining whether the goals and objectives have been achieved. If not, adjustments may need to be made to the plan or the implementation process.

(c) $\frac{3x + 1}{x + 4}$

2

1. The first step in the process of identifying a problem is to recognize that a problem exists. This involves gathering information about the situation and identifying the specific issue that needs to be addressed. Once the problem is identified, the next step is to define the problem in clear, concise terms. This involves determining the scope of the problem and the specific goals that need to be achieved. Once the problem is defined, the next step is to generate potential solutions. This involves brainstorming ideas and evaluating the pros and cons of each option. Once a solution is chosen, the next step is to implement the solution. This involves developing a plan of action and putting it into practice. Finally, the last step in the process is to evaluate the results of the solution. This involves monitoring the progress of the solution and making adjustments as needed to ensure that the problem is fully resolved.

15. The probability distribution table for the discrete random variable X is shown.

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x	0	1	2	3	4	5
$P(X=x)$	0.35	a	b	0.15	0.05	0.01

If $E(X) = 1.5$, find the values of a and b .

[illegible]

16. A survey contained a question asking eight households to estimate their weekly income.

The results of the survey were as follows.

\$600 \$1200 \$1600 \$1800 \$2000 \$2400 \$2600 \$4200

Identify any outlier(s) in this dataset. Justify your answer.

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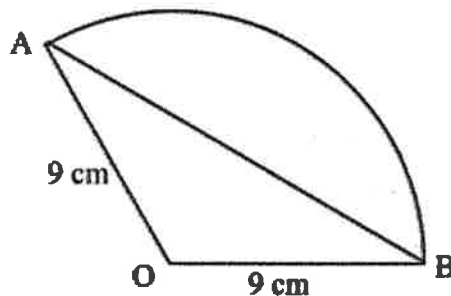
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17. In the diagram, AOB is a sector of a circle with centre at O and radius 9 cm. AB is a chord, and the length of arc AB is 6π cm.



- a) Show that the size of $\angle AOB = \frac{2\pi}{3}$.

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- b) Find the perimeter of the shaded minor segment.

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18. The function $y = \sin(x)$ undergoes a series of graphical transformations and becomes $y = 5\sin\left(2x + \frac{\pi}{3}\right)$. 3
Outline the transformations that were applied to $y = \sin(x)$ in the correct order.

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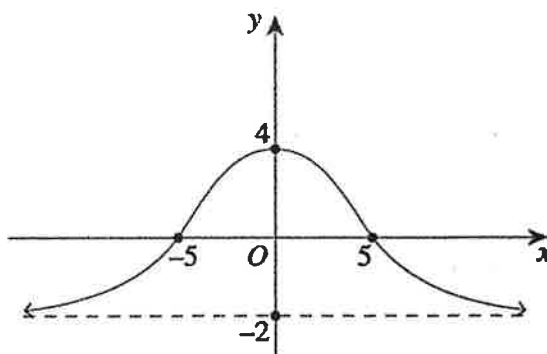
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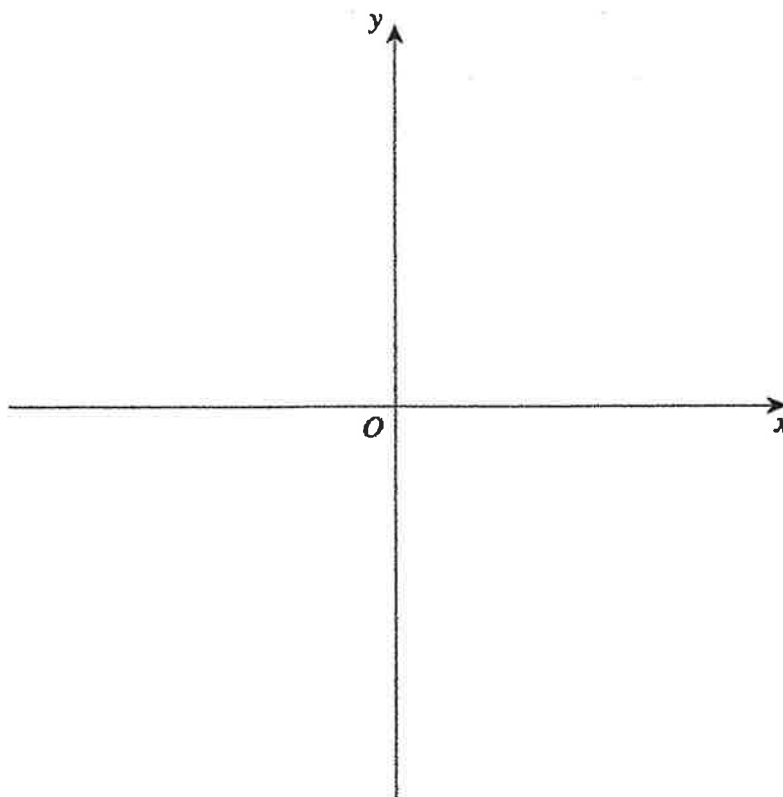
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19. The graph shows the function $y = f(x)$ with a horizontal asymptote at $y = -2$. 3



On the axes below, sketch the graph of $y = f'(x)$, clearly showing the behaviour at the intercepts and any asymptotes.



20. Prove that $(1 - \sin x)(\sec x + \tan x) \equiv \cos x$.

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21. Daniel has a bag that contains 5 red, and 8 black balls. Two balls are drawn randomly from the bag.

(a) Find the probability that the first ball drawn is red.

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(b) Find the probability that both balls drawn are the same colour.

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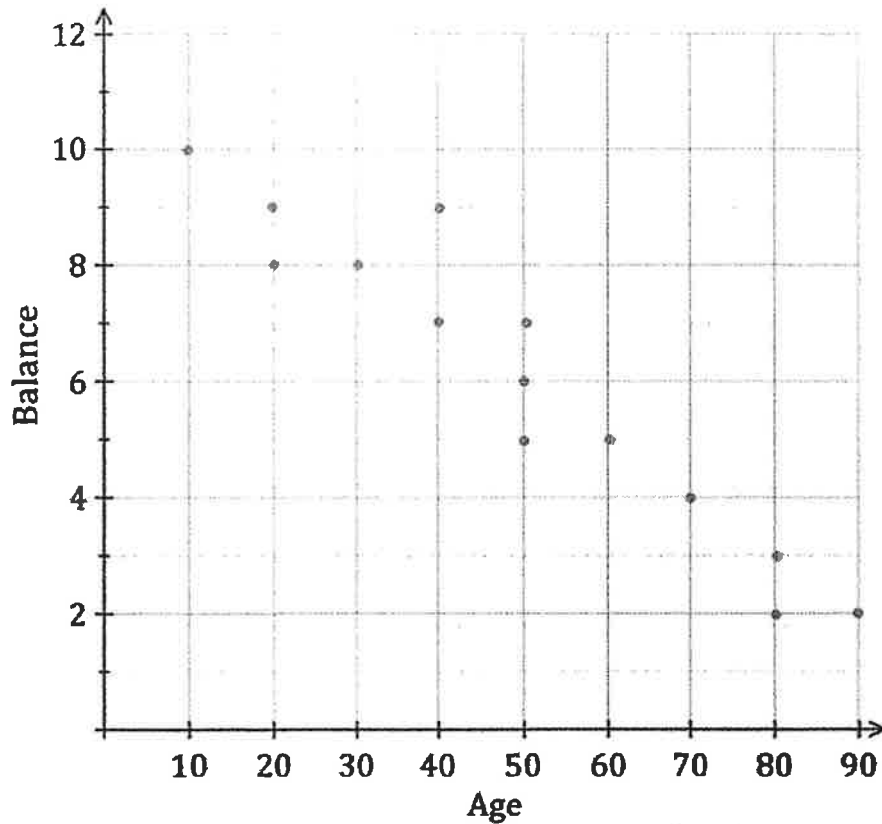
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22.

The scatterplot below shows the relationship between age and balance.



- (a) Draw a line of best fit on the scatterplot. Find the gradient of this line.

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- (b) Hannah is 40 years old. What is her expected balance ?

1

- (c) Calculate the value of the Pearson's correlation coefficient. Answer correct to two decimal places.

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23. (a)

Find the turning points and points of inflection on $y = x^4 - 2x^3 + 1$.

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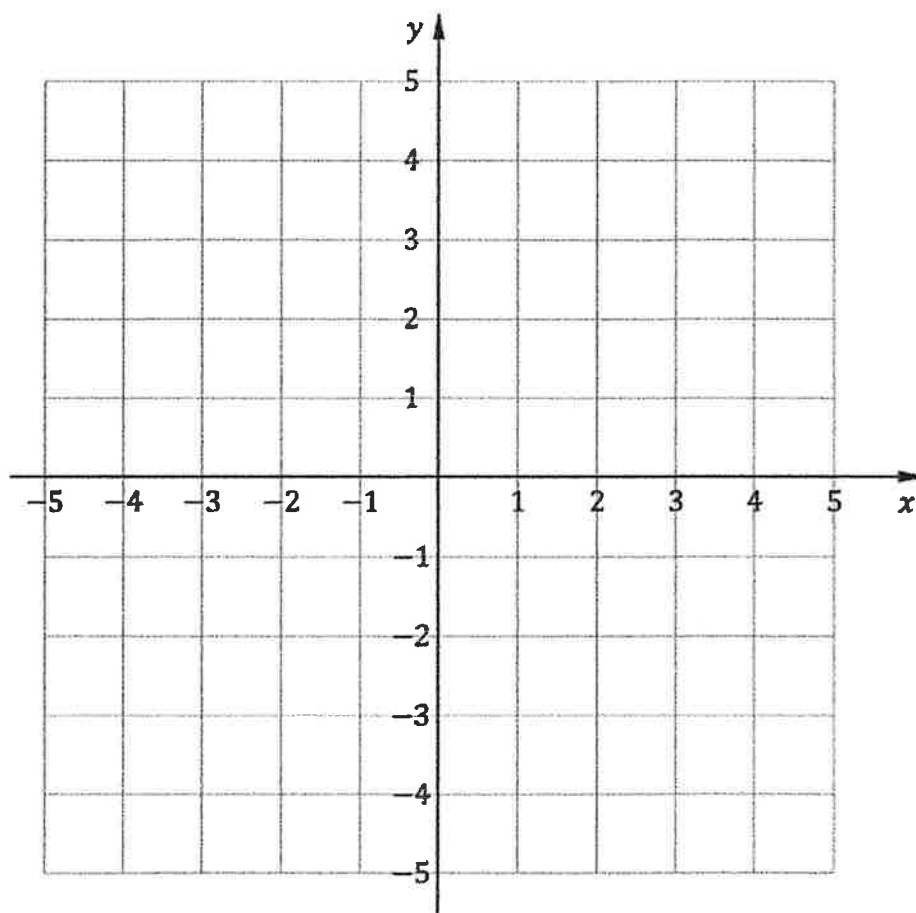
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(b) Sketch the graph $y = x^4 - 2x^3 + 1$ on the axes below, clearly showing the turning points and points of inflection. It is not necessary to find all x -intercepts.

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25.

- (a) Show that $\frac{d}{dx}(x \ln x - x) = \ln x$.

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- (b) Show that $y = \frac{1}{e}x$ is the equation of the tangent to the curve $y = \ln x$ at the point $(e, 1)$.

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26. A rational function $f(x)$ has the following properties,

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- The horizontal asymptote of its graph is $y = 0$
- The vertical asymptotes of its graph are $x = -2$ and $x = 2$
- The table below shows the first and second derivatives at various points.

	$x < -2$	$-2 < x < 0$	$x = 0$	$0 < x < 2$	$x > 2$
$f(x)$			1		
$f'(x)$	< 0	< 0	0	> 0	> 0
$f''(x)$	< 0	> 0	> 0	> 0	< 0

Sketch $y = f(x)$, using the properties in the table above.

27.

The height of a giraffe is modelled by $h = 590 - 460(1.1)^{-0.5t}$, where h is the height of the giraffe in centimetres (cm) and t is its age in months.

a) What is the height of the giraffe when its age is 10 months?

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b) At what rate is the height h increasing when its age is 15 months?

2

c) At what age will the height of the giraffe become 4 m?

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28. The price $P(t)$ in cents per litre of unleaded petrol during an average year in Broome WA, can be modelled by the function $P(t) = 180 + 44 \sin\left(\frac{2\pi t}{183}\right)$ where t is the number of days after 22 March 2023, for $0 \leq t \leq 366$.

(a) What is the maximum price of petrol during the year?

1

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(b) Sketch the function $P(t)$ for $0 \leq t \leq 366$.

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(c) What are the values of t for when petrol will cost 202 cents per litre.

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[illegible]