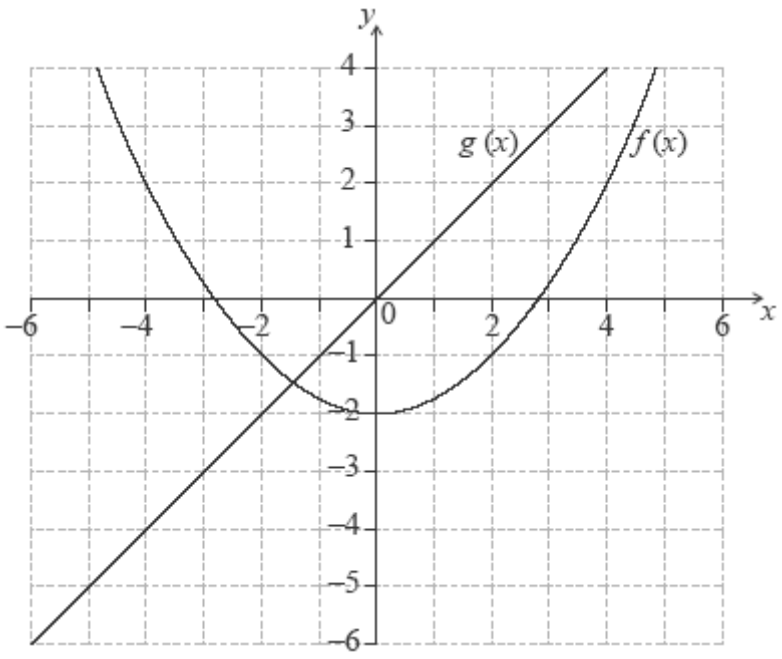
1. The figure shows the graphs of the functions $f(x) = \frac{1}{4}x^2 - 2$ and $g(x) = x$.



(a) Differentiate $f(x)$ with respect to x.

(1)

(b) Differentiate $g(x)$ with respect to x.

(1)

(c) Calculate the value of x for which the gradients of the two graphs are the same.

(2)

(d) Draw the tangent to the parabola at the point with the value of x found in part (c).

(2)

(Total 6 marks)

2. Let $f(x) = 2x^2 + x - 6$

(a) Find $f'(x)$.

(3)

(b) Find the value of $f'(-3)$.

(1)

(c) Find the value of x for which $f'(x) = 0$.

(Total 6 marks)

3. (a) Write $\frac{3}{x^2}$ in the form $3x^a$ where $a \in \mathbb{Z}$.

(b) Hence differentiate $y = \frac{3}{x^2}$ giving your answer in the form $\frac{b}{x^c}$ where $c \in \mathbb{Z}^+$.

(Total 6 marks)

4. (a) Differentiate the function $y = x^2 + 3x - 2$.

(b) At a certain point (x, y) on this curve the gradient is 5. Find the co-ordinates of this point.

(Total 6 marks)

5. Consider the function $f(x) = 2x^3 - 5x^2 + 3x + 1$.

(a) Find $f'(x)$.

(3)

(b) Write down the value of $f'(2)$.

(1)

(c) Find the equation of the tangent to the curve of $y = f(x)$ at the point (2, 3).

(2)

(Total 6 marks)

6. Consider the function $f(x) = \frac{1}{2}x^3 - 2x^2 + 3$.

(a) Find $f'(x)$.

(2)

(b) Find $f''(x)$.

(2)

(c) Find the equation of the tangent to the curve of f at the point (1, 1.5).

(2)

(Total 6 marks)

7. Consider $f : x \mapsto x^2 - 4$.

(a) Find $f'(x)$.

(1)

Let L be the line with equation $y = 3x + 2$.

(b) Write down the gradient of a line parallel to L.

(1)

(c) Let P be a point on the curve of f. At P, the tangent to the curve is parallel to L. Find the coordinates of P.

(4)
(Total 6 marks)

8. Consider the function $f(x) = \frac{3}{x^2} + x - 4$.

(a) Calculate the value of $f(x)$ when $x = 1$.

(2)

(b) Differentiate $f(x)$.

(4)

(c) Find $f'(1)$.

(2)

(d) Explain what $f'(1)$ represents.

(2)

(e) Find the equation of the tangent to the curve $f(x)$ at the point where $x = 1$.

(3)

(f) Determine the x-coordinate of the point where the gradient of the curve is zero.

(3)
(Total 16 marks)

9. Consider the function $f(x) = x^3 + \frac{48}{x}$, $x \neq 0$.

(a) Calculate $f(2)$.

(2)

(b) Sketch the graph of the function $y = f(x)$ for $-5 \leq x \leq 5$ and $-200 \leq y \leq 200$.

(4)

(c) Find $f'(x)$.

(3)

(d) Find $f'(2)$.

(2)

(e) Write down the coordinates of the local maximum point on the graph of f.

(2)

(f) Find the range of f.

(3)

(g) Find the gradient of the tangent to the graph of f at $x = 1$.

(2)

There is a second point on the graph of f at which the tangent is parallel to the tangent at $x = 1$.

(h) Find the x-coordinate of this point.

(2)

(Total 20 marks)

10. The function $f(x)$ is defined by $f(x) = 1.5x + 4 + \frac{6}{x}$, $x \neq 0$.

(a) Write down the equation of the vertical asymptote.

(2)

(b) Find $f'(x)$.

(3)

(c) Find the gradient of the graph of the function at $x = -1$.

(2)

(d) Using your answer to part (c), decide whether the function $f(x)$ is increasing or decreasing at $x = -1$. Justify your answer.

(2)

(e) Sketch the graph of $f(x)$ for $-10 \leq x \leq 10$ and $-20 \leq y \leq 20$.

(4)

P_1 is the local maximum point and P_2 is the local minimum point on the graph of $f(x)$.

(f) Using your graphic display calculator, write down the coordinates of

(i) P_1;

(ii) P_2.

(4)

(g) Using your sketch from (e), determine the range of the function $f(x)$ for $-10 \leq x \leq 10$.

(3)

(Total 20 marks)

11. Given $f(x) = x^2 - 3x^{-1}$, $x \in \mathbb{R}$, $-5 \leq x \leq 5$, $x \neq 0$,

(a) Write down the equation of the vertical asymptote.

(1)

(b) Find $f'(x)$.

(2)

(c) Using your graphic display calculator or otherwise, write down the coordinates of any point where the graph of $y = f(x)$ has zero gradient.

(2)

(d) Write down all intervals in the given domain for which $f(x)$ is increasing.

(3)

(Total 8 marks)

12. The function $f(x)$ is given by the formula

$$f(x) = 2x^3 - 5x^2 + 7x - 1$$

(a) Evaluate $f(1)$.

(2)

(b) Calculate $f'(x)$.

(3)

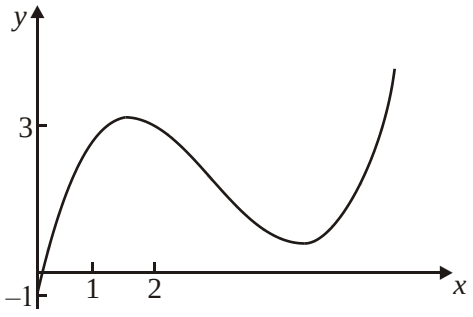
(c) Evaluate $f'(2)$.

(2)

(d) State whether the function $f(x)$ is increasing or decreasing at $x = 2$.

(1)

(e) The sketch graph shown below is the graph of a cubic function.



(i) Is it possible that this is the graph of the function $f(x)$ above?

(ii) State one reason for your decision.

(2)

(Total 10 marks)

13. Consider the function $g(x) = x^4 + 3x^3 + 2x^2 + x + 4$.

Find

(a) $g'(x)$

(3)

(b) $g'(1)$

(2)

(Total 5 marks)

14. A function $g(x) = x^3 + 6x^2 + 12x + 18$

(a) Find $g'(x)$.

(3)

(b) Solve $g'(x) = 0$.

(2)

(c) (i) Calculate the values of $g'(x)$ when

(a) $x = -3$;

(b) $x = 0$.

(ii) Hence state whether the function is increasing or decreasing at

(a) $x = -3$;

(b) $x = 0$.

(4)

(Total 9 marks)