

A curve has equation  $y = 3x^2 - x^3$ .

(a) Find the coordinates of the stationary points on this curve and determine their nature. 6

(b) State the coordinates of the points where the curve meets the coordinate axes and sketch the curve. 2

A curve has equation  $y = x^4 - 2x^3 + 5$ .

Find the equation of the tangent to this curve at the point where  $x = 2$ . 4

The point P (5, 12) lies on the curve with equation  $y = x^2 - 4x + 7$ .

What is the gradient of the tangent to this curve at P?

- A 2
- B 6
- C 12
- D 13

What is the gradient of the tangent to the curve with equation  $y = x^3 - 6x + 1$  at the point where  $x = -2$ ?

- A -24
- B 3
- C 5
- D 6

A function  $f$  is defined on the domain  $0 \leq x \leq 3$  by  $f(x) = x^3 - 2x^2 - 4x + 6$ .

Determine the maximum and minimum values of  $f$ . 7

If  $y = 3x^{-2} + 2x^{\frac{3}{2}}$ ,  $x > 0$ , determine  $\frac{dy}{dx}$ .

A  $-6x^{-3} + \frac{4}{5}x^{\frac{5}{2}}$

B  $-3x^{-1} + 3x^{\frac{1}{2}}$

C  $-6x^{-3} + 3x^{\frac{1}{2}}$

D  $-3x^{-1} + \frac{4}{5}x^{\frac{5}{2}}$

A tangent to the curve with equation  $y = x^3 - 2x$  is drawn at the point (2, 4).

What is the gradient of this tangent?

A 2

B 3

C 4

D 10

A function  $f$  is defined on the set of real numbers by  $f(x) = (x - 2)(x^2 + 1)$ .

(a) Find where the graph of  $y = f(x)$  cuts:

(i) the  $x$ -axis;

(ii) the  $y$ -axis.

2

(b) Find the coordinates of the stationary points on the curve with equation  $y = f(x)$  and determine their nature.

8

(c) On separate diagrams sketch the graphs of:

(i)  $y = f(x)$ ;

(ii)  $y = -f(x)$ .

3

If  $f(x) = \frac{1}{\sqrt[5]{x}}$ ,  $x \neq 0$ , what is  $f'(x)$ ?

A  $-\frac{1}{5}x^{-\frac{6}{5}}$

B  $-\frac{1}{5}x^{-\frac{4}{5}}$

C  $-\frac{5}{2}x^{-\frac{7}{2}}$

D  $-\frac{5}{2}x^{-\frac{3}{2}}$

The derivative of a function  $f$  is given by  $f'(x) = x^2 - 9$ .

Here are two statements about  $f$ :

- (1)  $f$  is increasing at  $x = 1$ ;
- (2)  $f$  is stationary at  $x = -3$ .

Which of the following is true?

- A Neither statement is correct.
- B Only statement (1) is correct.
- C Only statement (2) is correct.
- D Both statements are correct.

A curve has equation  $y = 5x^3 - 12x$ .

What is the gradient of the tangent at the point  $(1, -7)$ ?

- A  $-7$
- B  $-5$
- C  $3$
- D  $5$

Find the coordinates of the turning points of the curve with equation  $y = x^3 - 3x^2 - 9x + 12$  and determine their nature.

8

What is the derivative of  $\frac{1}{4x^3}$ ,  $x \neq 0$ ?

A  $\frac{1}{12x^2}$

B  $-\frac{1}{12x^2}$

C  $\frac{4}{x^4}$

D  $-\frac{3}{4x^4}$