

1 Differentiate the following with respect to  $x$ :

(a)  $f(x) = 3x^4 - x^2$

(b)  $f(x) = \sqrt{x^3}$

(c)  $y = \frac{1}{4x^2}$

(d)  $f(x) = (x+3)(x-2)$

(e)  $y = 2\sqrt{x} - \frac{4}{\sqrt{x}}$

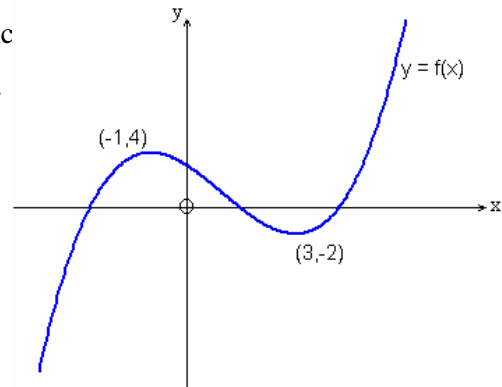
(f)  $y = \frac{6x^3 + 2x}{2x^2}$

2 (a) Find the gradient of the curve  $y = 2x^2 - 3x$  where  $x = 2$ .

(b) Find the equation of the tangent to the curve  $y = 4 - 3x^2$ , at the point where  $x = -1$ .

3 The diagram opposite shows a sketch of the cubic function  $f$ , with stationary points  $(-1,4)$  and  $(3,-2)$ .

Sketch the graph of the derived function  $f'$ .



4 Consider the function  $y = x^3(3 - x)$ .

(a) Find all points of intersection with the axes.

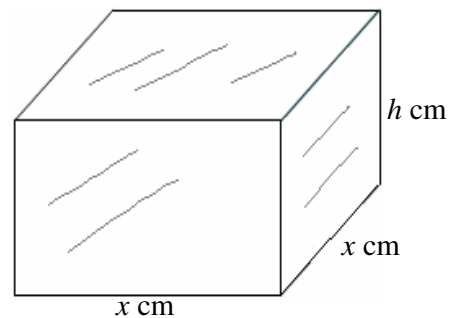
(b) Find the turning points and determine their nature.

(c) Sketch the curve, clearly showing all salient points.

5 A glass display case is to be constructed as a square based cuboid with an open base.

The volume of the case is  $500\text{cm}^3$ .

The case has side  $x$  cm and height  $h$  cm.



(a) Show that the area of glass required to make

the case is given by,  $A(x) = x^2 + \frac{2000}{x} \text{cm}^2$ .

(b) Find the dimensions of the case that minimises the area of glass used.