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2 The curve $y = x^2 - \frac{a}{x}$ has a stationary point at $(-3, b)$.

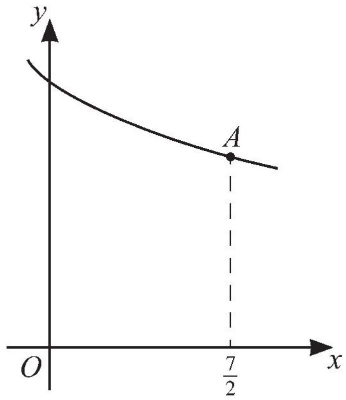
Find the values of the constants a and b. [4]

5 The equation of a curve is such that $\frac{dy}{dx} = 4x - 3\sqrt{x} + 1$.

(a) Find the x-coordinate of the point on the curve at which the gradient is $\frac{11}{2}$. [3]

(b) Given that the curve passes through the point (4, 11), find the equation of the curve. [4]

7



The diagram shows part of the curve with equation $y = \dfrac{12}{\sqrt[3]{2x+1}}$. The point A on the curve has coordinates $\left(\frac{7}{2}, 6\right)$.

(a) Find the equation of the tangent to the curve at A. Give your answer in the form $y = mx + c$. [4]

(b) Find the area of the region bounded by the curve and the lines $x = 0$, $x = \frac{7}{2}$ and $y = 0$. [4]

9 The equation of a curve is $y = 4 + 5x + 6x^2 - 3x^3$.

(a) Find the set of values of x for which y decreases as x increases. [4]

(b) It is given that $y = 9x + k$ is a tangent to the curve.

Find the value of the constant k. [4]

3 The equation of a curve is $y = 2x^2 - 3$. Two points A and B with x-coordinates 2 and $(2 + h)$ respectively lie on the curve.

(a) Find and simplify an expression for the gradient of the chord AB in terms of h. [3]

(b) Explain how the gradient of the curve at the point A can be deduced from the answer to part **(a)**, and state the value of this gradient. [2]

10 A function f with domain $x > 0$ is such that $f'(x) = 8(2x-3)^{\frac{1}{3}} - 10x^{\frac{2}{3}}$. It is given that the curve with equation $y = f(x)$ passes through the point $(1, 0)$.

(a) Find the equation of the normal to the curve at the point $(1, 0)$. [3]

(b) Find $f(x)$. [4]

It is given that the equation $f'(x) = 0$ can be expressed in the form

$$125x^2 - 128x + 192 = 0.$$

(c) Determine, making your reasoning clear, whether f is an increasing function, a decreasing function or neither. [3]

11 The equation of a curve is $y = kx^{\frac{1}{2}} - 4x^2 + 2$, where k is a constant.

(a) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ in terms of k. [2]

(b) It is given that $k = 2$.

Find the coordinates of the stationary point and determine its nature. [4]

(c) Points A and B on the curve have x-coordinates 0.25 and 1 respectively. For a different value of k, the tangents to the curve at the points A and B meet at a point with x-coordinate 0.6.

Find this value of k. [6]