1 **(i)** Differentiate $12\sqrt[3]{x}$. **[2]**

(ii) Integrate $\frac{6}{x^3}$. **[3]**

2 Use calculus to find the set of values of x for which $x^3 - 6x$ is an increasing function. **[5]**

3 The points P$(2, 3.6)$ and Q$(2.2, 2.4)$ lie on the curve $y = \mathrm{f}(x)$. Use P and Q to estimate the gradient of the curve at the point where $x = 2$. **[2]**

4 Find $\frac{dy}{dx}$ when

(i) $y = 2x^{-5}$, **[2]**

(ii) $y = \sqrt[3]{x}$. **[3]**

5 The equation of a curve is $y = \sqrt{1 + 2x}$.

(i) Calculate the gradient of the chord joining the points on the curve where $x = 4$ and $x = 4.1$. Give your answer correct to 4 decimal places. **[3]**

(ii) Showing the points you use, calculate the gradient of another chord of the curve which is a closer approximation to the gradient of the curve when $x = 4$. **[2]**

6

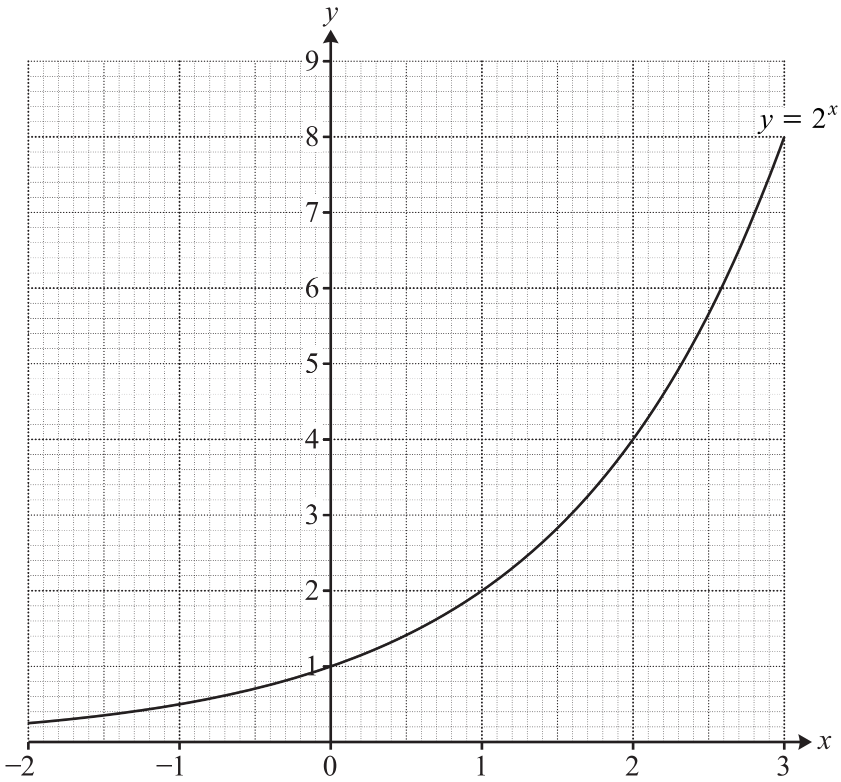

Fig. 5

Fig. 5 shows the graph of $y = 2^x$.

(i) On the copy of Fig. 5, draw by eye a tangent to the curve at the point where $x = 2$. Hence find an estimate of the gradient of $y = 2^x$ when $x = 2$. **[3]**

(ii) Calculate the y-values on the curve when $x = 1.8$ and $x = 2.2$. Hence calculate another approximation to the gradient of $y = 2^x$ when $x = 2$. **[2]**

7 Find $\frac{dy}{dx}$ when $y = \sqrt{x} + \frac{3}{x}$. **[3]**

8 The gradient of a curve is $6x^2 + 12x^{\frac{1}{2}}$. The curve passes through the point (4, 10). Find the equation of the curve. **[5]**

9 Use calculus to find the set of values of x for which $f(x) = 12x - x^3$ is an increasing function. [3]

10 Given tha $y = 6x^{\frac{3}{2}}$, find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.

Show, without using a calculator, that when $x = 36$ the value of $\frac{d^2y}{dx^2}$ is $\frac{3}{4}$. [5]

11 The gradient of a curve is given by $\frac{dy}{dx} = 3 - x^2$. The curve passes through the point $(6, 1)$. Find the equation of the curve. [4]

12 Given tha $y = 6x^3 + \sqrt{x} + 3$, find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$. [5]