

**EXERCISE 6.1**

- Find the rate of change of the area of a circle with respect to its radius  $r$  when
  - $r = 3$  cm
  - $r = 4$  cm
- The volume of a cube is increasing at the rate of  $8 \text{ cm}^3/\text{s}$ . How fast is the surface area increasing when the edge is 12 cm?
- The radius of a circle is increasing uniformly at  $3 \text{ cm/s}$ . Find the rate at which the area is increasing when the radius is 10 cm.
- An edge of a cube is increasing at  $3 \text{ cm/s}$ . How fast is the volume increasing when the edge is 10 cm?
- Waves move in circles at  $5 \text{ cm/s}$ . When the radius is 8 cm, how fast is the enclosed area increasing?

**EXERCISE 6.3**

- Find the slope of the tangent to  $y = 3x^4 - 4x$  at  $x = 4$ .
- Find the slope of the tangent to  $y = \frac{x-1}{x-2}$  at  $x = 10$ .
- Find the slope of the tangent to  $y = x^3 - x + 1$  at  $x = 2$ .
- Find the slope of the tangent to  $y = x^3 - 3x + 2$  at  $x = 3$ .
- Find the slope of the normal to  $x = a \cos^3 \theta$ ,  $y = a \sin^3 \theta$  at  $\theta = \frac{\pi}{4}$ .
- Find points at which the tangent to  $y = x^3 - 3x^2 - 9x + 7$  is parallel to the  $x$ -axis.

**EXERCISE 6.4**

- Using differentials, find the approximate value of each of the following up to 3 places of decimal.

(i)  $\sqrt{25.3}$

(ii)  $\sqrt{49.5}$

(iii)  $\sqrt{0.6}$

(iv)  $(0.009)^{\frac{1}{3}}$

(v)  $(0.999)^{\frac{1}{10}}$

(vi)  $(15)^{\frac{1}{4}}$

(vii)  $(26)^{\frac{1}{3}}$

(viii)  $(255)^{\frac{1}{4}}$

(ix)  $(82)^{\frac{1}{4}}$

(x)  $(401)^{\frac{1}{2}}$

(xi)  $(0.0037)^{\frac{1}{2}}$

(xii)  $(26.57)^{\frac{1}{3}}$

(xiii)  $(81.5)^{\frac{1}{4}}$

(xiv)  $(3.968)^{\frac{3}{2}}$

(xv)  $(32.15)^{\frac{1}{5}}$

- Find the approximate value of  $f(2.01)$ , where  $f(x) = 4x^2 + 5x + 2$ .
- Find the approximate value of  $f(5.001)$ , where  $f(x) = x^3 - 7x^2 + 15$ .

4. Find the approximate change in the volume of a cube of side  $x$  metres caused by increasing the side by 1%.
5. Find the approximate change in the surface area of a cube of side  $x$  metres caused by decreasing the side by 1%.

<b>EXERCISE 6.5</b>
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1. Find the maximum and minimum values of

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

(ii)  $f(x) = 9x^2 + 12x + 2$

(iii)  $f(x) = -(x - 1)^2 + 10$

(iv)  $g(x) = x^3 + 1$

2. Find the maximum and minimum values of

(i)  $f(x) = |x + 2| - 1$

(ii)  $g(x) = -|x + 1| + 3$

(iii)  $h(x) = \sin(2x) + 5$

(iv)  $f(x) = |\sin 4x + 3|$