

## Increasing and Decreasing Functions Questions

### Exercise 8D

- ① Work out the values of  $x$  for which the following functions are increasing.
- |                                |                               |
|--------------------------------|-------------------------------|
| (i) $y = x^2 + 4$              | (ii) $y = 2x - 3$             |
| (iii) $y = x^2 + 2x - 5$       | (iv) $y = x^2 - 3x$           |
| (v) $y = 3x^2 + 4x + 7$        | (vi) $y = (x + 6)(x - 2)$     |
| (vii) $y = x^3 - 2x^2$         | (viii) $y = x^3 + 6x^2 - 15x$ |
| (ix) $y = x^3 - 3x^2 - 9x + 1$ |                               |
- ② Work out the values of  $x$  for which the following functions are decreasing.
- |                                  |                                |
|----------------------------------|--------------------------------|
| (i) $y = 4x^2$                   | (ii) $y = x^2 - 6x + 2$        |
| (iii) $y = x(x + 2)$             | (iv) $y = 3 + 4x - x^2$        |
| (v) $y = 12 - x$                 | (vi) $y = (2x + 1)^2$          |
| (vii) $y = \frac{1}{3}x^3 + x^2$ | (viii) $y = 2x^3 - 3x^2 - 72x$ |
| (ix) $y = 27x - x^3$             |                                |

230/302 ⓘ

- ③ Prove that  $y = \frac{1}{3}x^3 + 2x^2 + 7x + 1$  is an increasing function for all values of  $x$ .
- ④ Prove that  $y = x^3 - 6x^2 + 27x - 4$  is an increasing function for all values of  $x$ .
- ⑤ Work out the values of  $x$  for which  $y = x^2 + \frac{2}{x}$  is an increasing function.
- ⑥ Prove that  $y = 12 - 2x - x^3$  is a decreasing function for all values of  $x$ .
- ⑦ Prove that  $y = \frac{1}{x}$  is a decreasing function for all  $x \neq 0$ .
- ⑧ Work out the values of  $x$  for which the following functions are
- |                                 |                                |
|---------------------------------|--------------------------------|
| (a) increasing                  | (b) decreasing.                |
| (i) $y = x + \frac{1}{x}$       | (ii) $y = x - \frac{1}{x}$     |
| (iii) $y = x^2 + \frac{1}{x^2}$ | (iv) $y = x^2 - \frac{1}{x^2}$ |
- ⑨ Air is being pumped into a spherical balloon at the rate of  $1000 \text{ cm}^3 \text{ s}^{-1}$ . Initially the balloon contains no air. (The formula for the volume of a sphere is  $V = \frac{4}{3}\pi r^3$ ).
- |   |
|---|
| (i) Calculate the volume $V$ of the balloon after 10 seconds. |
| (ii) Calculate the volume of the balloon after $t$ seconds.   |
| (iii) State the value of $\frac{dV}{dt}$ .                    |
| (iv) Calculate the radius of the balloon after $t$ seconds.   |