

## DIFFERENTIATION

## Answers

- 1** a  $2x$       b  $4x^3$       c  $1$       d  $9x^8$       e  $-3x^{-4}$       f  $-x^{-2}$   
g  $8x$       h  $7$       i  $10x^4$       j  $0$       k  $-16x^{-3}$       l  $-44x^{-5}$
- 2** a  $5x^4 + 2x$       b  $1 + 3x^2$       c  $4x^3$       d  $6x^5 - 2$   
e  $18x^2 - 10x^{-3}$       f  $2x - 4$       g  $-x^{-2} + 5x^{-6}$       h  $12x^2 - 12x^{-5}$
- 3** a  $6t^5$       b  $-15t^{-4}$       c  $\frac{1}{2}t^{-\frac{1}{2}}$       d  $\frac{2}{3}t^{-\frac{1}{3}}$       e  $\frac{3}{2}t$       f  $2t^{-\frac{3}{4}}$   
g  $7t^{\frac{5}{2}}$       h  $-\frac{1}{5}t^{-\frac{6}{5}}$       i  $\frac{3}{5}t^{\frac{1}{5}}$       j  $-\frac{3}{2}t^{-\frac{5}{2}}$       k  $-15t^{-\frac{9}{4}}$       l  $\frac{2}{9}t^{\frac{1}{3}}$
- 4** a  $2 + 2x^5$       b  $\frac{3}{2}x^{\frac{1}{2}}$       c  $1 + 2x^{-\frac{1}{2}}$       d  $10x^{\frac{2}{3}} + 4x^{-5}$   
e  $-\frac{4}{5}x^{-\frac{9}{5}}$       f  $\frac{1}{3}x^{-\frac{5}{6}} + \frac{3}{4}x^{-\frac{1}{4}}$       g  $-3x^{-2} + \frac{15}{2}x^{-\frac{5}{2}}$       h  $7x^{-2} - \frac{8}{3}x^{-\frac{11}{3}}$
- 5** a  $y = x^{\frac{1}{2}}$       b  $y = 4 - x^{-1}$       c  $y = 3x^2 + x^{\frac{1}{3}}$       d  $y = 9x + 3x^{-1}$   
 $\frac{dy}{dx} = \frac{1}{2}x^{-\frac{1}{2}}$        $\frac{dy}{dx} = x^{-2}$        $\frac{dy}{dx} = 6x + \frac{1}{3}x^{-\frac{2}{3}}$        $\frac{dy}{dx} = 9 - 3x^{-2}$
- e  $y = \frac{1}{4}x^{-1} - x^{-2}$       f  $y = 6x^{-\frac{1}{4}}$       g  $y = x^{\frac{5}{2}}$       h  $y = 8x^{\frac{1}{2}} + \frac{4}{3}x^{-2}$   
 $\frac{dy}{dx} = -\frac{1}{4}x^{-2} + 2x^{-3}$        $\frac{dy}{dx} = -\frac{3}{2}x^{-\frac{5}{4}}$        $\frac{dy}{dx} = \frac{5}{2}x^{\frac{3}{2}}$        $\frac{dy}{dx} = 4x^{-\frac{1}{2}} - \frac{8}{3}x^{-3}$
- 6** a  $s = t^2 + 3t$       b  $s = t^2 - 4t + 4$       c  $s = 5t^4 + 20t^2$       d  $s = 7t^3 - t$   
 $\frac{ds}{dt} = 2t + 3$        $\frac{ds}{dt} = 2t - 4$        $\frac{ds}{dt} = 20t^3 + 40t$        $\frac{ds}{dt} = 21t^2 - 1$
- e  $s = t^2 + 7t + 6$       f  $s = t^2 - 2t - 8$       g  $s = t^5 + 3t^3 + 9t$       h  $s = 2t^3 - 5t^2 + 3t$   
 $\frac{ds}{dt} = 2t + 7$        $\frac{ds}{dt} = 2t - 2$        $\frac{ds}{dt} = 5t^4 + 9t^2 + 9$        $\frac{ds}{dt} = 6t^2 - 10t + 3$
- 7** a  $y = x^{\frac{3}{2}} - 4x^{\frac{1}{2}}$       b  $y = x^2 - 2$       c  $y = 4x + x^{-1}$       d  $y = x^{\frac{1}{2}} + 3x^{-\frac{1}{2}}$   
 $\frac{dy}{dx} = \frac{3}{2}x^{\frac{1}{2}} - 2x^{-\frac{1}{2}}$        $\frac{dy}{dx} = 2x$        $\frac{dy}{dx} = 4 - x^{-2}$        $\frac{dy}{dx} = \frac{1}{2}x^{-\frac{1}{2}} - \frac{3}{2}x^{-\frac{3}{2}}$
- e  $y = 2x^{-1} - \frac{1}{2}x^2$       f  $y = 5x^{-2} + x^{-\frac{3}{2}}$       g  $y = 3 - \frac{2}{3}x^{-1}$       h  $y = 2x^{\frac{1}{2}} + \frac{1}{4}x^{\frac{5}{2}}$   
 $\frac{dy}{dx} = -2x^{-2} - x$        $\frac{dy}{dx} = -10x^{-3} - \frac{3}{2}x^{-\frac{5}{2}}$        $\frac{dy}{dx} = \frac{2}{3}x^{-2}$        $\frac{dy}{dx} = x^{-\frac{1}{2}} + \frac{5}{8}x^{\frac{3}{2}}$
- 8** a  $\frac{dy}{dx} = 8x - 1$       b  $\frac{dy}{dx} = 3x^2 + 10x + 2$       c  $\frac{dy}{dx} = 2x^{-2}$   
 $\frac{d^2y}{dx^2} = 8$        $\frac{d^2y}{dx^2} = 6x + 10$        $\frac{d^2y}{dx^2} = -4x^{-3}$
- d  $\frac{dy}{dx} = 8x^3 + 6x$       e  $y = 3x^4 - 4x^{-2}$       f  $\frac{dy}{dx} = 3x^{-\frac{1}{2}} + \frac{1}{2}x^{-\frac{3}{2}}$   
 $\frac{d^2y}{dx^2} = 24x^2 + 6$        $\frac{dy}{dx} = 12x^3 + 8x^{-3}$        $\frac{d^2y}{dx^2} = -\frac{3}{2}x^{-\frac{3}{2}} - \frac{3}{4}x^{-\frac{5}{2}}$   
 $\frac{d^2y}{dx^2} = 36x^2 - 24x^{-4}$