

- 1
- a** $= 1 + 4x + 6x^2 + 4x^3 + x^4$
- b** $= 1 - 5x + 10x^2 - 10x^3 + 5x^4 - x^5$
- c** $= 1 + 3(4x) + 3(4x)^2 + (4x)^3$
 $= 1 + 12x + 48x^2 + 64x^3$
- d** $= 1 + 3(-2y) + 3(-2y)^2 + (-2y)^3$
 $= 1 - 6y + 12y^2 - 8y^3$
- e** $= 1 + 4(\frac{1}{2}x) + 6(\frac{1}{2}x)^2 + 4(\frac{1}{2}x)^3 + (\frac{1}{2}x)^4$
 $= 1 + 2x + \frac{3}{2}x^2 + \frac{1}{2}x^3 + \frac{1}{16}x^4$
- f** $= 1 + 3(\frac{1}{3}y) + 3(\frac{1}{3}y)^2 + (\frac{1}{3}y)^3$
 $= 1 + y + \frac{1}{3}y^2 + \frac{1}{27}y^3$
- g** $= 1 + 5(x^2) + 10(x^2)^2 + 10(x^2)^3 + 5(x^2)^4 + (x^2)^5$
 $= 1 + 5x^2 + 10x^4 + 10x^6 + 5x^8 + x^{10}$
- h** $= 1 + 4(-\frac{3}{2}x) + 6(-\frac{3}{2}x)^2 + 4(-\frac{3}{2}x)^3 + (-\frac{3}{2}x)^4$
 $= 1 - 6x + \frac{27}{2}x^2 - \frac{27}{2}x^3 + \frac{81}{16}x^4$
- 2
- a** $= x^3 + 3x^2y + 3xy^2 + y^3$
- b** $= a^5 - 5a^4b + 10a^3b^2 - 10a^2b^3 + 5ab^4 - b^5$
- c** $= x^4 + 4x^3(2y) + 6x^2(2y)^2 + 4x(2y)^3 + (2y)^4$
 $= x^4 + 8x^3y + 24x^2y^2 + 32xy^3 + 16y^4$
- d** $= 2^3 + 3(2^2)y + 3(2)y^2 + y^3$
 $= 8 + 12y + 6y^2 + y^3$
- e** $= 3^3 + 3(3^2)(-x) + 3(3)(-x)^2 + (-x)^3$
 $= 27 - 27x + 9x^2 - x^3$
- f** $= 5^4 + 4(5^3)(2x) + 6(5^2)(2x)^2 + 4(5)(2x)^3 + (2x)^4$
 $= 625 + 1000x + 600x^2 + 160x^3 + 16x^4$
- g** $= 3^5 + 5(3^4)(-4y) + 10(3^3)(-4y)^2 + 10(3^2)(-4y)^3 + 5(3)(-4y)^4 + (-4y)^5$
 $= 243 - 1620y + 4320y^2 - 5760y^3 + 3840y^4 - 1024y^5$
- h** $= 3^4 + 4(3^3)(\frac{1}{2}x) + 6(3^2)(\frac{1}{2}x)^2 + 4(3)(\frac{1}{2}x)^3 + (\frac{1}{2}x)^4$
 $= 81 + 54x + \frac{27}{2}x^2 + \frac{3}{2}x^3 + \frac{1}{16}x^4$
- 3
- a** $= 1 + 10x + \frac{10 \times 9}{2}x^2 + \frac{10 \times 9 \times 8}{3 \times 2}x^3 + \dots$
 $= 1 + 10x + 45x^2 + 120x^3 + \dots$
- b** $= 1 + 6(-x) + \frac{6 \times 5}{2}(-x)^2 + \frac{6 \times 5 \times 4}{3 \times 2}(-x)^3 + \dots$
 $= 1 - 6x + 15x^2 - 20x^3 + \dots$
- c** $= 1 + 8(2x) + \frac{8 \times 7}{2}(2x)^2 + \frac{8 \times 7 \times 6}{3 \times 2}(2x)^3 + \dots$
 $= 1 + 16x + 112x^2 + 448x^3 + \dots$
- d** $= 1 + 7(-\frac{1}{2}x) + \frac{7 \times 6}{2}(-\frac{1}{2}x)^2 + \frac{7 \times 6 \times 5}{3 \times 2}(-\frac{1}{2}x)^3 + \dots$
 $= 1 - \frac{7}{2}x + \frac{21}{4}x^2 - \frac{35}{8}x^3 + \dots$
- e** $= 1 + 6(x^3) + \frac{6 \times 5}{2}(x^3)^2 + \frac{6 \times 5 \times 4}{3 \times 2}(x^3)^3 + \dots$
 $= 1 + 6x^3 + 15x^6 + 20x^9 + \dots$
- f** $= 2^9 + 9(2^8)x + \frac{9 \times 8}{2}(2^7)x^2 + \frac{9 \times 8 \times 7}{3 \times 2}(2^6)x^3 + \dots$
 $= 512 + 2304x + 4608x^2 + 5376x^3 + \dots$
- g** $= 3^7 + 7(3^6)(-x) + \frac{7 \times 6}{2}(3^5)(-x)^2 + \frac{7 \times 6 \times 5}{3 \times 2}(3^4)(-x)^3 + \dots$
 $= 2187 - 5103x + 5103x^2 - 2835x^3 + \dots$
- h** $= 2^{10} + 10(2^9)(5x) + \frac{10 \times 9}{2}(2^8)(5x)^2 + \frac{10 \times 9 \times 8}{3 \times 2}(2^7)(5x)^3 + \dots$
 $= 1024 + 25\,600x + 288\,000x^2 + 1\,920\,000x^3 + \dots$
- 4
- a** $= \binom{20}{3} = 1140$
- b** $= \binom{14}{4} \times (-1)^4 = 1001$
- c** $= \binom{9}{2} \times 4^2 = 576$
- d** $= \binom{14}{3} \times (-3)^3 = -9828$
- e** $= \binom{12}{4} \times (-\frac{1}{3})^4 = \frac{55}{9}$ or $6\frac{1}{9}$
- f** $= \binom{16}{5} \times (-\frac{1}{2})^5 = -136.5$
- g** $= \binom{15}{2} \times (\frac{2}{5})^2 = \frac{84}{5}$ or 16.8
- h** $= \binom{8}{3} = 56$

$$\begin{aligned}
 5 \quad \mathbf{a} &= 1 + 3(\sqrt{5}) + 3(\sqrt{5})^2 + (\sqrt{5})^3 \\
 &= 1 + 3\sqrt{5} + 15 + 5\sqrt{5} \\
 &= 16 + 8\sqrt{5} \\
 \mathbf{b} &= 1 + 4(-\sqrt{3}) + 6(-\sqrt{3})^2 + 4(-\sqrt{3})^3 + (-\sqrt{3})^4 \\
 &= 1 - 4\sqrt{3} + 18 - 12\sqrt{3} + 9 \\
 &= 28 - 16\sqrt{3}
 \end{aligned}$$

$$\begin{aligned}
 \mathbf{c} &= 2^3 + 3(2^2)(\sqrt{2}) + 3(2)(\sqrt{2})^2 + (\sqrt{2})^3 \\
 &= 8 + 12\sqrt{2} + 12 + 2\sqrt{2} \\
 &= 20 + 14\sqrt{2} \\
 \mathbf{d} &= 1 + 4(2\sqrt{3}) + 6(2\sqrt{3})^2 + 4(2\sqrt{3})^3 + (2\sqrt{3})^4 \\
 &= 1 + 8\sqrt{3} + 72 + 96\sqrt{3} + 144 \\
 &= 217 + 104\sqrt{3}
 \end{aligned}$$

$$\begin{aligned}
 6 \quad \mathbf{a} &= 1 + 6x + \frac{6 \times 5}{2} x^2 + \frac{6 \times 5 \times 4}{3 \times 2} x^3 + \dots \\
 &= 1 + 6x + 15x^2 + 20x^3 + \dots
 \end{aligned}$$

$$\begin{aligned}
 \mathbf{b} \quad \mathbf{i} \quad &\text{let } x = 0.02 \\
 1.02^6 &\approx 1 + 6(0.02) + 15(0.02)^2 + 20(0.02)^3 \\
 &= 1 + 0.12 + 0.0060 + 0.000160 \\
 &= 1.1262 \text{ (4dp)}
 \end{aligned}$$

$$\begin{aligned}
 \mathbf{ii} \quad &\text{let } x = -0.01 \\
 0.99^6 &\approx 1 + 6(-0.01) + 15(-0.01)^2 + 20(-0.01)^3 \\
 &= 1 - 0.06 + 0.0015 - 0.00020 \\
 &= 0.9415 \text{ (4dp)}
 \end{aligned}$$

$$\begin{aligned}
 7 \quad \mathbf{a} &= 1 + 8(2y) + \frac{8 \times 7}{2} (2y)^2 + \frac{8 \times 7 \times 6}{3 \times 2} (2y)^3 + \dots \\
 &= 1 + 16y + 112y^2 + 448y^3 + \dots
 \end{aligned}$$

$$\begin{aligned}
 \mathbf{b} \quad \mathbf{i} \quad &\text{let } y = -0.01 \\
 0.98^8 &\approx 1 + 16(-0.01) + 112(-0.01)^2 + 448(-0.01)^3 \\
 &= 1 - 0.16 + 0.0112 - 0.000448 \\
 &= 0.8508 \text{ (4dp)}
 \end{aligned}$$

$$\begin{aligned}
 \mathbf{ii} \quad &\text{let } y = 0.005 \\
 1.01^8 &\approx 1 + 16(0.005) + 112(0.005)^2 + 448(0.005)^3 \\
 &= 1 + 0.080 + 0.002800 + 0.000056000 \\
 &= 1.0829 \text{ (4dp)}
 \end{aligned}$$

$$\begin{aligned}
 8 \quad \mathbf{a} &= 1 + 4x + 6x^2 + 4x^3 + x^4 + (1 - 4x + 6x^2 - 4x^3 + x^4) \\
 &= 2 + 12x^2 + 2x^4
 \end{aligned}$$

$$\begin{aligned}
 \mathbf{b} &= 1 + 3(-\frac{1}{3}x) + 3(-\frac{1}{3}x)^2 + (-\frac{1}{3}x)^3 - [1 + 3(\frac{1}{3}x) + 3(\frac{1}{3}x)^2 + (\frac{1}{3}x)^3] \\
 &= 1 - x + \frac{1}{3}x^2 - \frac{1}{27}x^3 - (1 + x + \frac{1}{3}x^2 + \frac{1}{27}x^3) \\
 &= -2x - \frac{2}{27}x^3
 \end{aligned}$$

$$\begin{aligned}
 9 \quad \mathbf{a} \quad &6(ax)^2 = 24x^2 \\
 &a^2 = 4 \\
 &a < 0 \quad \therefore a = -2
 \end{aligned}$$

$$\mathbf{b} = 4a^3 = -32$$