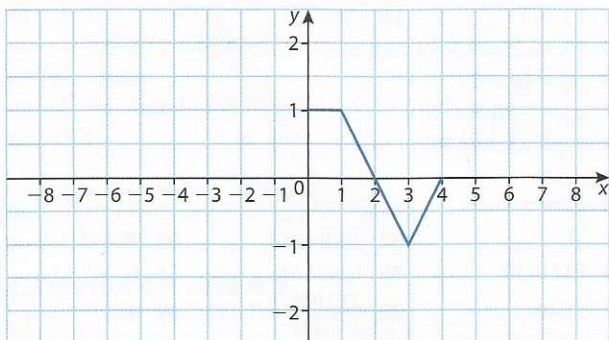
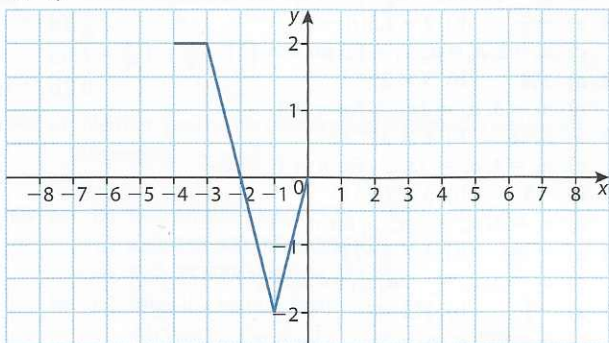


- 10 a) (i) $\sqrt{11}$ (ii) 7 (iii) 0
 b) $x < -3$ c) $(g \circ f)(x) = x - 2$
- 11 a) 4 b) $(g^{-1} \circ h)(x) = 2x^2 + 6$ c) $x = \pm 2\sqrt{2}$
- 12 a) $f^{-1}(x) = \frac{1}{3}x + \frac{1}{3}$
 b) $(f \circ g)(x) = \frac{12}{x} - 1$
 c) $(f \circ g)^{-1}(x) = \frac{12}{x+1}$
 d) $(g \circ g)(x) = x$
- 13 a) $f(x) = 2(x+2)^2 + 9$
 b) $g(x) = 2(x-3)^2 + 11$
- 14 a) $g(x) = 3(x-1)^2 - 7$
 b) Vertex: (1, -7) c) $x = 1$
 d) y -intercept: (0, -4) e) $p = 3, q = 21, r = 3$
- 15 a) (i) $a = 8$ (ii) $b = -3$
 b) Reflection over x -axis
- 16 a)



- b) $A'(-3, -2)$
- 17 a) $p = -3, q = \frac{1}{3}$ b) $x = -\frac{4}{3}$
 c) $f(x) = x^2 + \frac{8}{3}x - 1$
- 18 $A(-5, 0), B(-\frac{3}{2}, \frac{49}{4}), C(2, 0)$

Chapter 3

Exercise 3.1

- 1 -1, 1, 3, 5, 7, 97
 2 2, 6, 18, 54, 162, 4.786×10^{23}
 3 $\frac{2}{3}, -\frac{2}{3}, \frac{6}{11}, -\frac{4}{9}, \frac{10}{27}, \frac{50}{1251}$
 4 1, 2, 9, 64, 625, 1.776×10^{83}
 5 3, 11, 27, 59, 123, 4.50×10^{15}
 6 0, 3, $\frac{3}{7}, \frac{21}{13}, \frac{39}{55}$, approx. 1
 7 2, 6, 18, 54, 162, 4.786×10^{23}
 8 -1, 1, 3, 5, 7, 97

Exercise 3.2

- 1 3, $\frac{19}{5}, \frac{23}{5}, \frac{27}{5}, \frac{31}{5}, 7$
- 2 a) Arithmetic, $d = 2, a_{50} = 97$
 b) Arithmetic, $d = 1, a_{50} = 52$
 c) Arithmetic, $d = 2, a_{50} = 97$
 d) Not arithmetic, *no common difference*
 e) Not arithmetic, *no common difference*
 f) Arithmetic, $d = -7, a_{50} = -341$
- 3 a) 26
 b) $a_n = -2 + 4(n-1)$
 c) $a_1 = -2, a_n = a_{n-1} + 4$ for $n > 1$
- 4 a) 1
 b) $a_n = 29 - 4(n-1)$
 c) $a_1 = 29, a_n = a_{n-1} - 4$ for $n > 1$
- 5 a) 57
 b) $a_n = -6 + 9(n-1)$
 c) $a_1 = -6, a_n = a_{n-1} + 9$ for $n > 1$
- 6 a) 9.23
 b) $a_n = 10.07 - 0.12(n-1)$
 c) $a_1 = 10.07, a_n = a_{n-1} - 0.12$ for $n > 1$
- 7 a) 79
 b) $a_n = 100 - 3(n-1)$
 c) $a_1 = 100, a_n = a_{n-1} - 3$ for $n > 1$
- 8 a) $-\frac{27}{4}$
 b) $a_n = 2 - \frac{5}{4}(n-1)$
 c) $a_1 = 2, a_n = a_{n-1} - \frac{5}{4}$ for $n > 1$
- 9 13, 7, 1, -5, -11, -17, -23
- 10 299, $299\frac{1}{4}, 299\frac{1}{2}, 299\frac{3}{4}, 300$
- 11 $a_n = -10 + 4(n-1) = 4n - 14$
- 12 $a_n = -\frac{142}{3} + \frac{11}{3}(n-1) = -51 + \frac{11}{3}n$

Exercise 3.3

- 1 3, 6, 12, 24, 48, 96
- 2 a) Arithmetic, $d = 3, a_{10} = 27$
 b) Geometric, $r = 2, b_{10} = 4096$
 c) Neither, not geometric, $r = 2, c_{10} = -1534$
 d) Geometric, $r = 3, u_{10} = 78\,732$
 e) Geometric, $r = 2.5, a_{10} = 7629.394\,531\,25$
 f) Geometric, $r = -2.5, a_{10} = -7629.394\,531\,25$
 g) Arithmetic, $d = 0.75, a_{10} = 8.75$
 h) Geometric, $r = -\frac{2}{3}, a_{10} = -\frac{1024}{2187}$
- 3 a) $\frac{2187}{64}$ b) $a_n = -2(-\frac{3}{2})^{n-1}$
 c) $a_1 = -2, a_n = -\frac{3}{2}a_{n-1}, n > 1$
- 4 a) $\frac{390\,625}{117\,649}$ b) $a_n = 35(\frac{5}{7})^{n-1}$
 c) $a_1 = 35, a_n = \frac{5}{7}a_{n-1}, n > 1$
- 5 a) $-\frac{3}{64}$ b) $a_n = -6(\frac{1}{2})^{n-1}$
 c) $a_n = -6, a_n = \frac{1}{2}a_{n-1}, n > 1$
- 6 a) 1216 b) $9.5 \times 2^{n-1}$
 c) $a_1 = 9.5, a_n = 2a_{n-1}, n > 1$
- 7 a) $69.833\,729\,609\,375 = \frac{893\,871\,739}{12\,800\,000}$
 b) $a_n = 100(\frac{19}{20})^{n-1}$
 c) $a_1 = 100, a_n = \frac{19}{20}a_{n-1}, n > 1$

- 8 a) $0.002\ 085\ 685\ 73 = \frac{2187}{1\ 048\ 576}$
 b) $a_n = 2\left(\frac{3}{8}\right)^{n-1}$ c) $a_1 = 2, a_n = \frac{3}{8}a_{n-1}, n > 1$
 9 7, 35, 175, 875, 4375 10 36
 11 1.5, $a_n = 24\left(\frac{1}{2}\right)^{n-1}$ 12 $\frac{49}{3}$
 13 10th term 14 Yes, 10th term
 15 €2228.92 16 £945.23
 17 €2968.79 18 7745 thousands

Exercise 3.4

- 1 11 280 2 $-\frac{10\ 5469}{1024}$ 3 0.7
 4 $\frac{10}{7}$ 5 $\frac{16 + 4\sqrt{3}}{39}$
 6 a) $\frac{52}{99}$ b) $\frac{449}{990}$ c) $\frac{7459}{2475}$
 7 13 026.135 (£13 026.14)

Exercise 3.5

- 1 a) $x^5 + 10x^4y + 40x^3y^2 + 80x^2y^3 + 80xy^4 + 32y^5$
 b) $a^4 - 4a^3b + 6a^2b^2 - 4ab^3 + b^4$
 c) $x^6 - 18x^5 + 135x^4 - 540x^3 + 1215x^2 - 1458x + 729$
 d) $16 - 32x^3 + 24x^6 - 8x^9 + x^{12}$
 e) $x^7 - 21bx^6 + 189b^2x^5 - 945b^3x^4 + 2835b^4x^3 - 5103b^5x^2 + 5103b^6x - 2187b^7$
 f) $64n^6 + 192n^3 + 240 + \frac{160}{n^3} + \frac{60}{n^6} + \frac{12}{n^9} + \frac{1}{n^{12}}$
 g) $\frac{81}{x^4} - \frac{216}{x^2\sqrt{x}} + \frac{216}{x} - 96\sqrt{x} + 16x^2$
 2 a) 56 b) 0 c) 1225 d) 32 e) 64
 3 a) $x^7 + 14x^6y + 84x^5y^2 + 280x^4y^3 + 560x^3y^4 + 672x^2y^5 + 448xy^6 + 128y^7$
 b) $a^6 - 6a^5b + 15a^4b^2 - 20a^3b^3 + 15a^2b^4 - 6ab^5 + b^6$
 c) $x^5 - 15x^4 + 90x^3 - 270x^2 + 405x - 243$
 d) $x^{18} - 12x^{15} + 60x^{12} - 160x^9 + 240x^6 - 192x^3 + 64$
 e) $x^7 - 21bx^6 + 189b^2x^5 - 945b^3x^4 + 2835b^4x^3 - 5103b^5x^2 + 5103b^6x - 2187b^7$
 f) $64n^6 + 192n^3 + 240 + \frac{160}{n^3} + \frac{60}{n^6} + \frac{12}{n^9} + \frac{1}{n^{12}}$
 g) $\frac{81}{x^4} - \frac{216}{x^2\sqrt{x}} + \frac{216}{x} - 96\sqrt{x} + 16x^2$
 h) 112 i) $1792\sqrt{3}$
 j) 16 k) $-23 + 10i\sqrt{2}$
 4 a) $x^{45} - 90x^{43} + 3960x^{41}$
 b) Does not exist as the powers of x decrease by 2's starting at 45. There is no chance for any expression to have zero exponent.
 c) $\binom{45}{43}x^2\left(\frac{-2}{x}\right)^{43} + \binom{45}{44}x\left(\frac{-2}{x}\right)^{44} + \left(\frac{-2}{x}\right)^{45} = -\binom{45}{43}\frac{2^{43}}{x^{41}} + \binom{45}{44}\frac{2^{44}}{x^{43}} - \frac{2^{45}}{x^{45}}$
 d) $\binom{45}{21}x^{24}\left(\frac{-2}{x}\right)^{21} = -\binom{45}{21} \cdot 2^{21}x^3$
 5 $\binom{n}{k} = \frac{n!}{k!(n-k)!} = \frac{n!}{(n-k)!k!} = \frac{n!}{(n-k)!(n-(n-k))!} = \binom{n}{n-k}$
 6 $(1+1)^n = \binom{n}{0} + \binom{n}{1} + \binom{n}{2} + \dots + \binom{n}{n}$
 $2^n = 1 + \binom{n}{1} + \binom{n}{2} + \dots + \binom{n}{n} \Rightarrow 2^n - 1 = \binom{n}{1} + \binom{n}{2} + \dots + \binom{n}{n}$
 7 Answers vary 8 $\left(\frac{1}{3} + \frac{2}{3}\right)^6 = 1$
 9 $\left(\frac{2}{5} + \frac{3}{5}\right)^8 = 1$ 10 $\left(\frac{1}{7} + \frac{6}{7}\right)^n = 1$

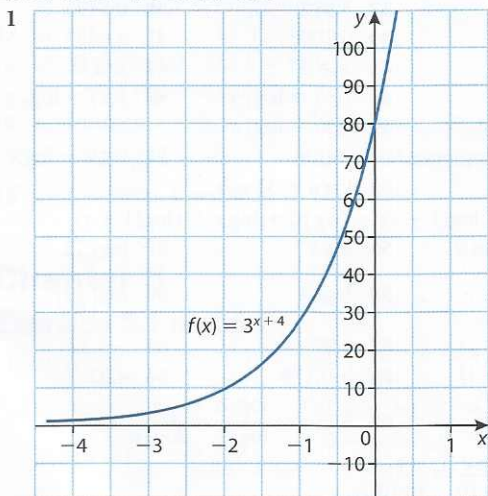
Practice questions

- 1 -1, 1, 3, 5, 7 2 -1, 1, 5, 13, 29
 3 $\frac{3}{2}, \frac{3}{4}, \frac{3}{8}, \frac{3}{16}, \frac{3}{32}$ 4 5, 8, 11, 14, 17
 5 1, 7, -5, 19, -29 6 3, 7, 13, 21, 31
 7 Arithmetic, $d = 3$ 8 Geometric, $r = -3$
 9 Geometric, $r = 2$ 10 Neither
 11 Neither 12 Arithmetic, $d = 1.3$
 13 a) 32 b) $-3 + 5(n-1)$
 c) $a_1 = -3, a_n = a_{n-1} + 5$ for $n > 1$
 14 a) -9 b) $19 - 4(n-1)$
 c) $a_1 = 19, a_n = a_{n-1} - 4$ for $n > 1$
 15 a) 69 b) $-8 + 11(n-1)$
 c) $a_1 = -8, a_n = a_{n-1} + 11$ for $n > 1$
 16 a) 9.35 b) $10.05 - 0.1(n-1)$
 c) $a_1 = 10.05, a_n = a_{n-1} - 0.1$ for $n > 1$
 17 a) 93 b) $100 - (n-1)$
 c) $a_1 = 100, a_n = a_{n-1} - 1$ for $n > 1$
 18 a) $-\frac{17}{2}$ b) $2 - 1.5(n-1)$
 c) $a_1 = 2, a_n = a_{n-1} - 1.5$ for $n > 1$
 19 a) 384 b) $3 \times 2^{n-1}$
 c) $a_1 = 3, a_n = 2a_{n-1}$ for $n > 1$
 20 a) 8748 b) $4 \times 3^{n-1}$
 c) $a_1 = 4, a_n = 3a_{n-1}$ for $n > 1$
 21 a) -5 b) $5 \times (-1)^{n-1}$
 c) $a_1 = 5, a_n = -a_{n-1}$ for $n > 1$
 22 a) -384 b) $3 \times (-2)^{n-1}$
 c) $a_1 = 3, a_n = -2a_{n-1}$ for $n > 1$
 23 a) $-\frac{4}{9}$ b) $972 \times \left(-\frac{1}{3}\right)^{n-1}$
 c) $a_1 = 972, a_n = \left(-\frac{1}{3}\right)a_{n-1}$ for $n > 1$
 24 15, 9, 3, -3, -9, -15, -21
 25 99, 99.25, 99.5, 99.75, 100
 26 $a_n = 4n - 1$
 27 $a_n = -86 + \left(\frac{19}{3}\right)(n-1)$
 28 7, 21, 63, 189, 567, 1701
 29 ± 24
 30 $a_4 = \pm 3, r = \pm \left(\frac{1}{2}\right), a_n = 24\left(\frac{1}{2}\right)^{n-1}$ or $a_n = 24\left(-\frac{1}{2}\right)^{n-1}$
 31 $\frac{98}{9}$ 32 10th term 33 Yes, 10th term
 34 €3714.87 35 £2921.16 36 €2098.63
 37 11 400 38 $\frac{210\ 938}{177\ 147} \approx 1.191$ 39 49.2
 40 $\frac{6}{5}$ 41 $\frac{3 + \sqrt{6}}{2}$
 42 a) $\frac{7}{9}$ b) $\frac{38}{110}$ c) $\frac{31\ 808}{9900}$
 43 -145 152 44 $35a^3$ 45 96 096
 46 $243n^5 - 810n^4m + 1080n^3m^2 - 720n^2m^3 + 240nm^4 - 32m^5$
 47 7 838 208
 48 $d = 5, n = 20$
 49 a) Nick: 20
 Charlotte: 17.6
 b) Nick: 390
 Charlotte: 381.3
 c) Charlotte will exceed the 40 hours during week 14.
 d) In week 12 Charlotte will catch up with Nick and exceed him.
 50 a) Loss for the second month = 1060 g
 Loss for the third month = 1123.6 g
 b) Plan A loss = 1880 g
 Plan B loss = 1898.3 g
 c) (i) Loss due to plan A in all 12 months = 17 280 g
 (ii) Loss due to Plan B in all 12 months = 16 869.9 g

- 51 a) €895.42 b) €6985.82
- 52 a) 142.5
b) 19 003.5
- 53 a) On the 37th day
b) 407 km
- 54 a) 1.5
b) 207 595
c) 2009
d) 619 583
e) Market saturation
- 55 -4, 3006
- 56 a) $\sqrt{\frac{1}{4} + \frac{1}{4}} = \frac{\sqrt{2}}{2}$ b) $\frac{1}{2}$
c) (i) $\frac{1}{4}$ (ii) $\frac{1}{2}$ d) (i) $\frac{1}{512}$ (ii) 2
- 57 a) 1220 b) 36 920
- 58 a) Area A = 1, Area B = $\frac{1}{9}$
b) $\frac{1}{81}$
c) $1 + \frac{8}{9}, 1 + \frac{8}{9} + \left(\frac{8}{9}\right)^2$
d) 0
- 59 a) Neither, geometric converging, arithmetic, geometric diverging
b) 6
- 60 a) (i) Kell: 18 400, 18 800; YBO: 18 190, 19 463.3
(ii) Kell: 198 000; YBO: 234 879.62
(iii) Kell: 21 600; YBO: 31 253.81
b) (i) After the second year
(ii) 4th year
- 61 a) 62 b) 936
- 62 a) $7000(1 + 0.0525)^t$
b) 7 years
c) Yes, since $10\,084.7 > 10\,015.0$
- 63 a) 11 b) 2 c) 15

Chapter 4

Exercise 4.1 and 4.2



domain: $x \in \mathbb{R}$

range: $y > 0$

y-intercept: $(0, 81)$

horizontal asymptote: $y = 0$ (x -axis)