N1.1

1 a Nigeria **b** 1.08×10^8 **c** 4.2×10^7
2 a 15 **b** 525
3 i 360000 **ii** 0.0029
4 $2^2 \times 5 \times 7$
5 a $7p$ **b i** xy **ii** $x^2 y^2$
6 4.3×10^3
7 a 5.72×10^6 **b** 1.4×10^{-7}
8 a 5.4×10^{-11} **b** 3.67×10^{-20}

N2

1 411
2 a 0.08717948718 **b** 0.087
3 a 55.25 **b** 0.882
4 a $\dfrac{31}{40}$ **b** $2\dfrac{11}{12}$
5 $\dfrac{7}{24}$
6 a 9.719 11.710 **b** 10 since both bounds agree
7 a 1.75 1.65 31.05 30.95 **b** 29.2 **c** 5531

N3

1 11%
2 a $\dfrac{4}{5}$ **b** $3\dfrac{1}{5}$
3 172
4 a 62.9 **b** 65
5 $\dfrac{23}{99}$
6 a i 9 **ii** multiple of 5 **b** 1.4 to 2 s.f.
7 $\dfrac{23}{45}$
8 $2\dfrac{11}{12}$
9 $\dfrac{31}{15}$

N4

1 200 150 225 150 10
2 9
3 704
4 600
5 a 150 **b** 320
6 a 7.5 **b** 95
7 a Mars **b** 1:30
8 $\dfrac{1}{4}$
9 a 5062.50 **b** 0.4096

N5

1 a $\dfrac{1}{8}$ **b** $\dfrac{3}{7}$ **c** $\dfrac{9}{64}$
2 a $3\sqrt{2}$ **b** $\dfrac{\sqrt{2}}{32}$

3 a i 2^7 **ii** 3^6 **b** 0
4 a $2^{\frac{3}{2}}$ **b** $9^{\frac{1}{4}}$ **c** $2^{-2.5}$
5 46 6
6 a i 1 **ii** $\dfrac{1}{25}$ **iii** $\dfrac{1}{3}$ **iv** 5 **b** $\dfrac{2-k}{2}$
7 $\dfrac{7}{2}$
8 a 4 **b** $2\sqrt{10}$ **c** 81.3%
9 a 6 **b** $\dfrac{1}{4}$
10 $-3 \pm \sqrt{13}$
11 a 3^4 **b** $2^{-3} \times 5^2$

N6

1 a 10 0.8 **b** $\dfrac{v^2}{2g}$
2 a 27.22 **b** 27
3 a $1\dfrac{1}{3}$ **b** $2\dfrac{9}{10}$
4 8.09
5 21
6 17
7 2.00
8 22.8
9 a $2 + 3 \times 4$ **b** $(2 + 3) \div 4$ **c** $2 \div 3 \times 4$

N7

1 i $B \subset A$ **ii** $a \cap B = \emptyset$
2 a $7 - x$ **b** 3
3 a i 5 **ii** 7 **iii** 9 **b i** 3 **ii** 15 **iii** 0
4 a 11, 12, 13, 15 **b** $\emptyset$
 c No, 11 is not a multiple of 3
5 a i – ii e.g. 5, 10, 20 **b i – ii** e.g. 15, 45, 75
6 a Kitchen chairs **b i** 1, 2, 3, 4, 5, 6, 7, 8, 9,
 ii Yes P all even
7 both in P but not intersecting

S1

1 14 300
2 24
3 264
4 a 138.2 **b** –
5 a 42 **b** 630
6 576
7 151
8 116
9 95.5

S2

1 55
2 15
3 $50 + x$
4 36

5 15
6 a i 61 **ii** cyclic quadrilateral
  b 29
7 144
8 a i 55 **ii** same arc
  b i 85 **ii** Cyclic quadrilateral
  c No, subtended angle $\neq 90°$
9 71
10 28

S3
1 a Enlargement Scale factor 3 about (1, 2)
  b triangle at (1, 6) (3, 6) (3, 7)
2 a triangle at (2, 6) (0, 6) (2, 10)
  b triangle at (6, 3) (6, 4) (8, 3)
3 a Rotation, 90° clockwise about (2, 0)
  b F T T F
4 No
5 a 49 **b i** 3.75 **ii** 1
6 a 3.5 **b** 2.7
7 a 0.162 **b** 43200
8 a 6.5 **b** 8320
9 a $1:\sqrt{k}$ **b** 7.1
10 8

S4
1 7.22
2 a 30 **b** 10.2
3 0.3096
4 a – **b** 1.58
5 5.74 (2 d.p.)
6 4

S5
1 a 290 **b** 146
2 –
3 –
4 –
5 –
6 232.4
7 17.6
8 a 5.66 **b** 38.9 **c** 33.6
9 a 335 **b** 104.5
10 27.6

S6
1 23.9
2 1.31
3 a 12.6 **b** 2.6
4 15
5 15π
6 a i $\frac{1}{3}\pi x^2$ **ii** $\frac{2\pi x}{3}$ **b** 27
7 a 128π **b** 112π
8 a 21.8 **b** 66.4

S7
1 (7, − 1)
2 a $\begin{pmatrix} 4 \\ 3 \end{pmatrix}$ **b** $\begin{pmatrix} -4 \\ 1 \end{pmatrix}$
3 a $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ **b i** $k\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ **ii** $\begin{pmatrix} -1+5k \\ -2+2k \end{pmatrix}$ **iii** $\begin{pmatrix} 4-5k \\ -2k \end{pmatrix}$
  c 0.5 **d** $k = \frac{1}{2} \rightarrow \times$ midpoint of OB
4 a i $-a + b$ **ii** $2a$ **iii** $-2a + 2b$
  b parallel, $QR = 2MN$
5 a i $a + \frac{1}{2}b$ **ii** $b + \frac{1}{2}a$ **iii** $-a + b$
  b $\overline{XY} = \frac{1}{2}(b-a) = \frac{1}{2}\overline{QS}$
6 a i $-6a + 6b$ **ii** $6a$ **b** $12b - 3a$
  c $\overline{EY} = \frac{4}{3}\overline{EX}$ and E common
7 –
8 i $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ **ii** $\begin{pmatrix} 5 \\ 10 \end{pmatrix}$
9 a $2a + 4c$ **b** $\overline{OM} = \frac{3}{2}\overline{OP}$ and O common

S8
1 a 57.6 **b** 2 **c** 80
2 1.79
3 3.156990642
4 a i (90, 1) **ii** (180, 0) **b i** (45, 0) **ii** (90, −3)
5 $A = 2, k = 6$
6 a i $\frac{1}{2}$ **ii** $-\frac{1}{2}$ **b i** 114, 246 **ii** 41, 319

D1
1 a 2 **b** B more consistent, B higher median so on average better
2 9.5
3 a i 16 **ii** 17.5 **iii** 17.3
  b i up
  ii New student age > original mean value
4 a 4 **b** 5, 5, 8 **c** e.g. 4, 5, 7, 7
5 a 1.8
  b $p = q$, equal number of values in each list

D2
1 a 28, 50, 64, 74, 80 **b** – **c** 14
2 a i 42 **ii** 10 **b** 28
3 a 74 **b** 22 **c** 20 **d** 7
4 a 3, 13, 30, 60, 81, 88, 90 **b** – **c** 37 **d** 64

D3
1 a 18 **b** 12
2 0.16
3 0.4
4 a 0.3 **b** 170

5 a i 0.9 **ii** 0.1 **b i** 0.09 **ii** 0.48
6 $\frac{91}{216}$
7 $\frac{29}{45}$
8 $\frac{660}{1000}$
9 $\frac{26}{56}$

D4
1 Heights of bars in the ratio: 1, 4, 1.6
2 a 120, 72 **b** –
3 348
4 a bar heights: 1, 4, 2.8, 0.4 **b** 9
5 a i – **ii** 130, 120 **b** 2500

D5
1 a $\frac{1}{6}$ **b** $\frac{7}{18}$
2 a 32 **b** 21
3 a – **b** $\frac{7}{18}$ **c** $\frac{25}{36}$
4 –
5 a No **b** – **c i** $\frac{1}{36}$ **ii** $\frac{11}{36}$
6 a – **b** $\frac{3}{28}$

A1
1 a $6t + 10$ **b** $y^3 - 3y^2$ **c** $x^2 + 10x + 21$ **d** p^7q^8
2 a $12x^2 + x - 35$ **b** $8p^{12}$ **c** $16y^4$
3 a k^3 **b i** $6x - 1$ **ii** $x^2 + 5xy + 6y^2$
  c $(p + q)(p + q + 5)$ **d** m^8 **e** $6t^6r^3$
4 –
5 a $2x(5x - 1)$ **b** $(x + 3)(x - 3)$ **c** $(3x - 1)(x - 4)$
6 –
7 $(3x - 1)(3x - 1)$
8 a $x(x + 1)$ **b** $(y + 5)(y - 7)$

A2
1 a $6x$, $4(x + 7)$ **b i** $4x + 28 = 6$ **ii** 14
2 −1.5
3 $\frac{x - 4}{2x - 3}$
4 a $9x - 5$ **b** 6
5 a $-6x + 23$ **b** $32x^5y^{15}$ **c** $\frac{2(n-1)}{n-2}$
6 a 7 **b** $\frac{2x}{2x + 3}$
7 0.75
8 $\frac{4}{5}$
9 $\frac{3}{x + 4}$

A3
1 $4n + 6$
2 i add 3 more every time
  ii difference are consecutive square numbers
3 a −4 **b** 14 **c** $3n + 5$
4 a 17, 27 **b** 10
5 1.12 or −1.79
6 a $4n - 1$ **b** Yes, 80th term
7 a $n^2 - (n - 1)(n + 1)$ **b** 1
8 i $(x - 3)(x - 4)$ **ii** 3, 4
9 a – **b i** $-\frac{13}{3}, \frac{3}{2}$ **ii** 8
10 $-\frac{1}{2}, \frac{3}{2}$

A4
1 $x < 1.5$
2 a $y = 2x - 4$ **b** –
3 region bounded by the three lines
4 region bounded by the three lines
5 −2, −1, 0, 1, 2, 3
6 $y = 4x + 5$
7 $y = 2x + 6$
8 $y = -2x + 5$
9 $6 < x \leq 9$
10 $y = 2x - 4$
11 i $\frac{5}{3}$ **ii** (0, −2)
12 C E A D B

A5
1 $\frac{1}{m} + u$
2 lh^2
3 $\sqrt{\frac{A}{\pi} + r^2}$
4 $\frac{cp}{q - p}$
5 Show that $(2n + 1)^2 + (2m + 1)^2 = 4(n^2 + n + m) + 2$
6 Yes
7 a $5n$
  b i $5n + 5(n + 1) = 10n + 5 = even + odd = odd$
    ii $5n \times 5(n + 1) = 25n(n + 1) = odd \times even = even$
8 Show it simplifies to $4n$
9 a 60 **b** $\frac{200p - 20}{3}$ **c** $\frac{240 + 36w}{180 - 3w}$
10 e.g. $6 \times 13 - 1 = 77 \times 11$

A6
1 $\frac{5}{3}, -1$
2 a $-2 \leq x \leq 2$ **b** –
3 a $(5 - x)^2 + (6 - x)^2 = (x + 4)^2$ **b** 1.58

4 $\left(\frac{4}{5}, \frac{22}{5}\right)$ *and* (4, –2)

5 a $\left(\frac{1}{2}, 1\right)$ **b** $\left(\frac{1}{2}, 1\right)$

6 a –   **b** 23.5, –8.5
7 a $y = 2x + 3$ **b** (0.5, 0.5)
8 (5.5, 14)

A7

1 a 36, 56, 48, 20   **b** –   **c** 60.5
2 a i (0, 9)   **ii** (8, 25)   –
3 a –   **b i** 1.42 or –8.42   **ii** 13.68
4 a $x^2 = \sqrt{-9}$, not possible   **b** (3, 4) or $\left(-\frac{7}{5}, \frac{24}{5}\right)$
5 250

A8

1 Line through (0, –2) and (2, 8)
2 a 5, –1,   **b** –   **c** –1.25
3 a 2.125, –1   **b** –
4 i H   **ii** D   **iii** A
5 a 5.4, 3.3, 3, 4.5   **b** –   **c** 0.6, 3.4
     d $y = 7 - x$
6 a 0.25, 2.5, 8, 15.25   **b** –   **c** 1.4
     d 2.5

A9

1 36
2 50
3 7.2

4 D   A   B   C
5 a $x = 4.9t^2$ **b** 44.1   **c** 1.43

6 a i $R = \frac{3.6}{r^2}$ **ii** –   **b** 0.4

7 a 24   84   **b** Home   **c** 0 and 40
     d 15   **e** 84

A10

1 a i $\frac{3}{2}$ **ii** $\frac{3}{4}$ **b** 1

     c i x **ii** $f(x) = f^{-1}(x)$
2 a $-1 \leqslant f(x) \leqslant 1$ **b** $p = 0$ $q = 45$
3 a 3   **b** –0.9, 2.5   **c** –13   **d** 3.8
     e $2 < k < 7$
4 $x = 10$ *or*   3
5 a –11   **b** 4   **c** 4   **d** $x < 0$
     e $(x - 1)^2$

A11

1 a $5000 - 1250x$ **b** (4, 10000)
     c i Maximum   **ii** graph is ∩ shaped
     d i 4   **ii** Maximum profit
2 a $3x^2 - 12$ **b** –12   **c** $A(-2, 43)$ $B(2, 1)$
3 $40t^{-3}$
4 a $3t^2 + 4t - 5$ **b** 20
5 a $x(28 - 2x)$
     b i $28 - 4x$ **ii** 7   **iii** graph is ∩ shaped
     c 98
6