Exam Level Questions
Worked Solutions

Chapter 2
Surds
2D Exam Style Questions

1. $\sqrt{2}\left(\sqrt{8}-\sqrt{2}\right)$

$= \sqrt{2}\sqrt{8}-\sqrt{2}\sqrt{2}$

$= \sqrt{16}-2$ **1,1**

$= 2$ **1**

2. $\sqrt{3}\left(\sqrt{3}+\sqrt{5}\right)-2\sqrt{15}$

$= \sqrt{3}\sqrt{3}+\sqrt{3}\sqrt{5}-2\sqrt{15}$

$= 3+\sqrt{15}-2\sqrt{15}$ **1,1**

$= 3-\sqrt{15}$ **1**

3. $\sqrt{80}+4\sqrt{5}-\sqrt{125}$

$= \sqrt{16\times 5}+4\sqrt{5}-\sqrt{25\times 5}$

$= 4\sqrt{5}+4\sqrt{5}-5\sqrt{5}$ **1,1**

$= 3\sqrt{5}$ **1**

4. $\sqrt{98}-8\sqrt{2}$

$= \sqrt{49\times 2}-8\sqrt{2}$

$= 7\sqrt{2}-8\sqrt{2}$ **1**

$= -\sqrt{2}$ **1**

5. $\dfrac{15}{3\sqrt{5}}$

$= \dfrac{15}{3\sqrt{5}}\times\dfrac{\sqrt{5}}{\sqrt{5}}$

$= \dfrac{15\sqrt{5}}{15}$ **1**

$= \sqrt{5}$ **1**

6. $\sqrt{4^2+6^2}$ **1**

$= \sqrt{16+36}$

$= \sqrt{52}$ **1**

$= \sqrt{4\times 13}$

$= 2\sqrt{13}$ **1**

7. $\dfrac{\sqrt{12}}{3\sqrt{8}}$

$= \dfrac{\sqrt{12}}{3\sqrt{8}}\times\dfrac{\sqrt{8}}{\sqrt{8}}$

$= \dfrac{\sqrt{96}}{3\times 8}$ **1**

$= \dfrac{\sqrt{16\times 6}}{24}$

$= \dfrac{4\sqrt{6}}{24}$ **1**

$= \dfrac{\sqrt{6}}{6}$ **1**

8. $\sqrt{8}+3\sqrt{2}-\sqrt{242}$

$= \sqrt{4\times 2}+3\sqrt{2}-\sqrt{121\times 2}$

$= 2\sqrt{2}+3\sqrt{2}-11\sqrt{2}$ **1,1**

$= -6\sqrt{2}$ **1**

9. $\dfrac{27}{\sqrt{3}}$

$= \dfrac{27}{\sqrt{3}}\times\dfrac{\sqrt{3}}{\sqrt{3}}$

$= \dfrac{27\sqrt{3}}{\sqrt{9}}$

$= \dfrac{27\sqrt{3}}{3}$ **1**

$= \dfrac{9}{\sqrt{3}}$ **1**

10. $a^2=\left(\sqrt{4^2}\right)^2-2$

$a^2 = 16-2$

$a^2 = 14$

$a = \sqrt{14}$ **1**

$\text{area} = \frac{1}{2}bh$

$\text{area} = \frac{1}{2}\left(\sqrt{2}\right)\left(\sqrt{14}\right)$ **1**

$\text{area} = \frac{1}{2}\sqrt{28}$

$\text{area} = \frac{1}{2}\left(\sqrt{4}\right)\left(\sqrt{7}\right)$

$\text{area} = \frac{1}{2}(2)\left(\sqrt{7}\right)$ **1**

$\text{area} = \sqrt{7}\ \text{m}^2$ **1**

Chapter 3
Indices
3D Exam Style Questions

1. $\frac{5a^{-3}}{a \times a^{4}}$

$= \frac{5a^{-3}}{a^{5}}$ 1

$= 5a^{-8}$ 1

$= \frac{5}{a^{8}}$ 1

2. $\frac{c^{2} \times 2c^{-3}}{\sqrt{c}}$

$= \frac{2c^{-1}}{c^{\frac{1}{2}}}$ 1,1

$= \frac{2}{c^{\frac{3}{2}}}$ 1

3. $\frac{8e^{5} \times 5e^{3}}{2e}$

$= \frac{40e^{8}}{2e}$ 1

$= 20e^{7}$ 1

4. $64^{\frac{2}{3}}$

$= \sqrt[3]{64^{2}}$ 1

$= 4^{2}$

$= 16$ 1

5. $(a^{4})^{2} \times a^{-3}$

$= a^{8} \times a^{-3}$ 1

$= a^{5}$ 1

6. $(b^{-4})^{3} \times b^{-7}$

$= b^{-12} \times b^{-7}$ 1

$= b^{-19}$ 1

$= \frac{1}{b^{19}}$ 1

7. $3^{-2} \times 4^{0}$

$= 3^{-2} \times 1$ 1

$= \frac{1}{9}$ 1

8. $2^{-4} \times 7^{0}$

$= 2^{-4} \times 1$ 1

$= \frac{1}{16}$ 1

9. $\left(\frac{1}{3}a^{3}\right)^{2}$

$= \left(\frac{1}{3}a^{3}\right) \times \left(\frac{1}{3}a^{3}\right)$

$= \frac{1}{9}a^{6}$ 1,1

10. $\left(\frac{1}{2}a^{2}\right)^{4}$

$= \left(\frac{1}{2}a^{2}\right) \times \left(\frac{1}{2}a^{2}\right) \times \left(\frac{1}{2}a^{2}\right) \times \left(\frac{1}{2}a^{2}\right)$

$= \frac{1}{16}a^{8}$ 1,1

Chapter 4
Standard Form/Scientific Notation
4D Exam Style Questions

1. $785 \div 2.5 \times 10^{-3}$ 1

$= 314\ 000$

$= 3.14 \times 10^{5}$ mosquitoes 1

2. $5.46 \times 10^{7} \times 25$ 1

$= 1\ 365\ 000\ 000$

$= 1.365 \times 10^{9}$ km 1

3. $1.8 \times 10^{5} \div 1.5 \times 10^{-1}$ 1

$= 1\ 200\ 000$

$= 1.2 \times 10^{6}$ times larger 1

4. $125 \div 1.3 \times 10^{-3}$ 1

$= 96153.846...$

$= 96\ 200$ chia seeds (3 s.f.) 1

5. $0.9 \div 100 \times 3.68 \times 1010$ **1**

$= 331\,200\,000$ **1**

$= 3.312 \times 10^8$ tonnes **1**

6. $92\% = 2.5 \times 10^6$ **1**

$1\% = 2.5 \times 10^6 \div 92 = 27173.9130\ldots$ **1**

$100\% = 2717391.304\ldots$ **1**

$= 2\,720\,000$

$= 2.72 \times 10^6$ rivets **1**

7. $1.03 \div 6.954 \times 10^{10}$ **1**

$= 7.16262 \times 10^{10}$ **1**

$= \$7.16 \times 10^{10}$ **1**

8. $3 \times 10^8 \div 3.43 \times 10^2$ **1**

$= 874635.5685$ **1**

$= 8.7 \times 10^5$ times **1**

9. time = distance ÷ speed

time $= 1.5 \times 10^{11} \div 3 \times 10^8$ **1**

time = 500 seconds

$\frac{500}{60} = 8.3333$ minutes **1**

= 8 minutes 20 seconds **1**

10. $1.028 \times 4.75 \times 10^7$ **1,1**

$= 48\,830\,000$

$= 4.883 \times 10^7$ individuals **1**

Chapter 5
Expanding Brackets
5D Exam Style Questions

1. $(x + 3)(x - 5) + 2(x + 7)$

$= x^2 + 5x - 3x - 10 + 2x + 14$ **1,1**

$= x^2 - 1$ **1**

2. $(4r - 1)(5r - 5) - 3(r - 2)$

$= 20r^2 - 20r - 5r + 5 - 3r + 6$ **1,1**

$= 20r^2 - 28r + 11$ **1**

3. $(2y + 8)(y - 3) + 2(y^2 + 7)$

$= 2y^2 - 6y + 8y - 24 + 2y^2 + 14$ **1,1**

$= 4y^2 + 2y - 10$ **1**

4. $(3e + 1)^2 + 5(e - 2)$

$= 9e^2 + 6e + 1 + 5e - 10$ **1,1**

$= 9e^2 + 11e - 9$ **1**

5. $(x + 5)(2x^2 + 3x + 5)$

$= 2x^3 + 3x^2 + 5x + 10x^2 + 15x + 25$ **1,1**

$= 2x^3 + 13x^2 + 20x + 25$ **1**

6. $(2x - 1)(3x^2 - 4x + 5)$

$= 6x^3 - 8x^2 + 10x - 3x^2 + 4x - 5$ **1,1**

$= 6x^3 - 11x^2 + 14x - 5$ **1**

7. $(3x - 2)(2x^2 - 9x - 3)$

$= 6x^3 - 27x^2 - 9x - 4x^2 + 18x + 6$ **1,1**

$= 6x^3 - 31x^2 + 9x + 6$ **1**

8. $n^4(6n - n^{-4})$

$= 6n^5 - n^0$ **1,1**

$= 6n^5 - 1$ **1**

9. $y^{\frac{1}{2}}(5y + y^{-3})$

$= 5y^{\frac{3}{2}} + y^{-\frac{5}{2}}$ **1,1**

10. $5s - (2s - 9)^2$

$= 5s - (4s^2 - 36s + 81)$ **1**

$= 5s - 4s^2 + 36s - 81$ **1**

$= -4s^2 + 41s - 81$ **1**

Chapter 6
Factorising
6D Exam Style Questions

1. $4x^2 - 100$

$= 4(x^2 - 25)$ **1**

$= 4(x - 5)(x + 5)$ **1**

2. $5x^2 + 5x - 30$

$= 5(x^2 + x - 6)$ **1**

$= 5(x - 2)(x + 3)$ **1**

3. $y^2 - 15y$

$= y(y - 15)$ **1**

4. $6x^2 - 54$

$= 6(x^2 - 9)$ **1**

$= 6(x - 3)(x + 3)$ **1**

5. $4x^2 + 4x - 15$

$= (2x - 3)(2x + 5)$ **1,1**

6. $6x^2 - 12x - 18$

$= 6(x^2 - 2x - 3)$ **1**

$= 6(x - 3)(x + 1)$ **1**

7. $x^2 - 1$

$= (x - 1)(x + 1)$ **1**

8. $\dfrac{x^2 - 9}{(x - 3)(x + 2)}$

$= \dfrac{(x - 3)(x + 3)}{(x - 3)(x + 2)}$ **1**

$= \dfrac{x + 3}{x + 2}$ **1**

9. $x^2 - 10x + 21$

$= (x - 3)(x - 7)$ **1,1**

10. $\dfrac{9x^2 - 16}{6x^2 + 8x}$

$= \dfrac{(3x - 4)(3x + 4)}{2x(3x + 4)}$ **1,1**

$= \dfrac{3x - 4}{2x}$ **1**

Chapter 7
Completing the Square
7D Exam Style Questions

1. $x^2 + 12x - 2$

$= (x^2 + 12x) - 2$

$= (x + 6)^2 - 2 - 36$

$= (x + 6)^2 - 38$ **1,1**

2. $x^2 - 9x$

$= (x^2 - 9x)$

$= (x - \frac{9}{2})^2 - (\frac{9}{2})^2$

$= (x - \frac{9}{2})^2 - \frac{81}{4}$ **1,1**

3. $x^2 - 4x - 13$

$= (x^2 - 2x) - 13$

$= (x - 2)^2 - 13 - 4$

$= (x - 2)^2 - 17$ **1,1**

4. $x^2 + 6x + 13$

$= (x^2 + 6x) + 13$

$= (x + 3)^2 + 13 - 9$

$= (x + 3)^2 + 4$ **1**

$a = 3$ and $b = 4$ **1**

5. $x^2 - 14x + 1$

$= (x^2 - 14x) + 1$

$= (x - 7)^2 + 1 - 49$

$= (x - 7)^2 - 48$, $p = 7$ **1,1**

6. $x^2 + 20x - 30$

$= (x^2 + 20x) - 30$

$= (x + 10)^2 - 30 - 100$

$= (x + 10)^2 - 130$, $q = -130$ **1,1**

7. $x^2 + 14x$

$= (x^2 + 14x)$

$= (x + 7)^2 - 49$ **1,1**

8. $5 + 20x - x^2$

$= -x^2 + 20x + 5$

$= -(x^2 - 20x) + 5$

$= -(x - 10)^2 + 5 - (-1)(100)$

$= -(x + 10)^2 + 105$

$= 105 - (x + 10)^2$ **1,1**

9. $12x - x^2$

$= -x^2 + 12x$

$= -(x^2 - 12x)$

$= -(x - 6)^2 - (-1)(36)$

$= -(x - 6)^2 + 36$

$= 36 - (x - 6)^2$ **1,1**

10. $x^2 + 5 - 4x$

$= x^2 - 4x + 5$

$= (x - 2)^2 + 5 - 4$

$= (x - 2)^2 + 1$ **1,1**

Chapter 8
Algebraic Fractions
8D Exam Style Questions

1. $\frac{7}{(y-4)} - \frac{2}{(y+3)}$

$= \frac{7(y+3)}{(y-4)(y+3)} - \frac{2(y-4)}{(y-4)(y+3)}$ **1,1**

$= \frac{7y + 21 - 2y + 8}{(y-4)(y+3)}$

$= \frac{5y + 29}{(y-4)(y+3)}$ **1**

2. $\frac{5}{b+2} - \frac{3}{b}$

$= \frac{5b}{(b)(b+2)} - \frac{3(b+2)}{b(b+2)}$ **1,1**

$= \frac{5b - 3b - 6}{(b)(b+2)}$

$= \frac{2(b-3)}{b(b+2)}$ **1**

3. $\frac{6}{y^3} - \frac{5}{y}$

$= \frac{6y}{y^4} - \frac{5y^3}{y^4}$ **1**

$= \frac{6y - 5y^3}{y^4}$

$= \frac{6 - 5y^2}{y^3}$ **1**

4. $\frac{8x}{y} \div \frac{x}{7y^3}$

$= \frac{8x}{y} \times \frac{7y^3}{x}$ **1**

$= \frac{8}{1} \times \frac{7y^2}{1}$ **1**

$= 56y^2$ **1**

5. $\frac{4a}{b} \div \frac{2a^3}{b+3}$

$= \frac{4a}{b} \times \frac{b+3}{2a^3}$ **1**

$= \frac{4}{b} \times \frac{b+3}{2a^2}$ **1**

$= \frac{4(b+3)}{2(a^2b)}$

$= \frac{2(b+3)}{a^2b}$ **1**

6. $\frac{e}{e^2 - 16} \div \frac{5}{e+4}$

$= \frac{e}{e^2 - 16} \times \frac{e+4}{5}$ **1**

$= \frac{e}{(e-4)(e+4)} \times \frac{(e+4)}{5}$ **1**

$= \frac{e}{5(e-4)}$ **1**

7. $\frac{3a + 6}{a + 2}$

$= \frac{3(a+2)}{(a+2)}$ **1**

$= 3$ **1**

8. $\frac{a^2 - 9a}{a^2 - 81}$

$= \frac{a(a-9)}{(a-9)(a+9)}$ **1,1**

$= \frac{a}{a+9}$ **1**

9. $\dfrac{10ab + 30b}{a^2 + 4a + 3}$

$= \dfrac{10b(a + 3)}{(a + 3)(a + 1)}$ **1,1**

$= \dfrac{10b}{(a + 1)}$ **1**

10. $\dfrac{x^2 - x - 20}{x^2 + 6x + 8}$

$= \dfrac{(x - 5)(x + 4)}{(x + 2)(x + 4)}$ **1,1**

$= \dfrac{x - 5}{x + 2}$ **1**

Chapter 9
Gradients
9D Exam Style Questions

1. $(-3, 4)$ $(1, 16)$
x_1, y_1 x_2, y_2

$m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m = \dfrac{16 - 4}{1 - (-3)}$

$m = \dfrac{12}{4}$

$m = 3$ **1**

2. $(-3, 9)$ $(5, 9)$
x_1, y_1 x_2, y_2

$m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m = \dfrac{9 - 9}{5 - (-3)}$

$m = \dfrac{0}{8}$

$m = 0$ **1**

3. $(6, 5)$ $(6, -2)$
x_1, y_1 x_2, y_2

$m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m = \dfrac{2 - 5}{6 - 6}$

$m = \dfrac{-3}{0}$

$m =$ undefined **1**

4. $A(1, 3)$ $B(3, 7)$ $C(8, 7)$ $D(12, 15)$
x_1, y_1 x_2, y_2 x_1, y_1 x_2, y_2

$m_{AB} = \dfrac{y_2 - y_1}{x_2 - x_1}$ $m_{CD} = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m_{AB} = \dfrac{7 - 3}{3 - 1}$ $m_{CD} = \dfrac{15 - 7}{12 - 8}$

$m_{AB} = \dfrac{4}{2}$ $m_{CD} = \dfrac{8}{4}$

$m_{AB} = 2$ $m_{CD} = 2$ **1,1**

As $m_{AB} = m_{CD}$, lines are parallel **1**

5. $F(-6, 1)$ $G(3, -2)$ $H(9, 10)$ $J(12, 9)$
x_1, y_1 x_2, y_2 x_1, y_1 x_2, y_2

$m_{FG} = \dfrac{y_2 - y_1}{x_2 - x_1}$ $m_{HJ} = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m_{FG} = \dfrac{-2 - 1}{3 - (-6)}$ $m_{HJ} = \dfrac{9 - 10}{12 - 9}$

$m_{FG} = \dfrac{-3}{9}$ $m_{HJ} = \dfrac{-1}{3}$

$m_{FG} = -\dfrac{1}{3}$ $m_{HJ} = -\dfrac{1}{3}$ **1,1**

As $m_{FG} = m_{HJ}$, lines are parallel **1**

6. $(7, 3)$ $(a, 15)$ $m = 3$
x_1, y_1 x_2, y_2

$m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$3 = \dfrac{15 - 3}{a - 7}$ **1**

$3 = \dfrac{12}{a - 7}$

$3(a - 7) = 12$ **1**

$a - 7 = 4$

$a = 11$ **1**

7. $(2, -1)$ $(-4, b)$ $m = -4$
x_1, y_1 x_2, y_2

$m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$-4 = \dfrac{b - (-1)}{-4 - 2}$ **1**

$-4 = \dfrac{b + 1}{-6}$

$b + 1 = 24$ **1**

$b = 23$ **1**

8. $(2, 4)$ (a, a^2) $m = 1$
x_1, y_1 x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$1 = \frac{a^2 - 4}{a - 2}$ **1**

$1 = \frac{(a - 2)(a + 2)}{a - 2}$ **1**

$a + 2 = 1$

$a = -1$ **1**

9. $(5, 8)$ $(p^2, 4p)$ $m = 1$
x_1, y_1 x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$1 = \frac{4p - 8}{p^2 - 5}$ **1**

$p^2 - 5 = 4p - 8$

$p^2 - 4p + 3 = 0$

$(p - 1)(p - 3) = 0$ **1**

$p - 1 = 0$ and $p - 3 = 0$

$p = 1$ and $p = 3$ **1**

10. $(0, 20)$ $(3e, 5e^2)$ $m = -5$
x_1, y_2 x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$-5 = \frac{5e^2 - 20}{3e - 0}$ **1**

$5e^2 - 20 = -15e$

$5e^2 + 15e - 20 = 0$

$5(e^2 + 3e - 4) = 0$

$5(e - 1)(e + 4) = 0$ **1**

$e - 1 = 0$ and $e + 4 = 0$

$e = 1$ and $e = -4$ **1**

Chapter 10
Circles: Arcs and Sectors
10D Exam Style Questions

1. $\frac{\text{Arc Length}}{\pi D} = \frac{\text{angle}}{360}$ $r = 12$ so $D = 24$

$\text{Arc Length} = \frac{\text{angle}}{360} \times \pi \times D$

$= \frac{30}{360} \times 3.14 \times 24$ **1,1**

$= \frac{1}{12} \times 3.14 \times 24$

$= 6.28$ cm **1**

2. $\frac{\text{Sector Area}}{\pi r^2} = \frac{\text{angle}}{360}$

$\text{Sector Area} = \frac{\text{angle}}{360} \times 3.14 \times 6^2$

$= \frac{60}{360} \times 3.14 \times 36$ **1,1**

$= \frac{1}{6} \times 3.14 \times 36$

$= 6 \div 3.14$

$= 18.84$ cm^2 **1**

3. $\frac{\text{Arc Length}}{\pi D} = \frac{\text{angle}}{360}$ $\text{Angle} = 360 - 48 = 312°$

$\text{Arc Length} = \frac{312}{360} \times \pi \times 24$ **1,1**

$= 65.3$ cm **1**

4. $\frac{\text{Sector Area}}{\pi r^2} = \frac{\text{angle}}{360}$

$\text{angle} = \frac{\text{Area} \times 360}{\pi r^2}$ **1**

$\text{angle} = \frac{166 \times 360}{\pi \times 15^2}$ **1**

$\text{angle} = 84.543...$

$= 84.5°$ **1**

5. $\frac{\text{Sector Area}}{\pi r^2} = \frac{\text{angle}}{360}$

$\text{Sector Area} = \frac{28}{360} \times \pi \times 1.5^2$ **1,1**

$= 0.54977$ **1**

$\text{Total Area} = 5 \times 0.54977$

$= 2.74885 = 2.7$ cm^2 **1**

6. $\frac{\text{Sector Area}}{\pi r^2} = \frac{\text{Arc}}{\pi D}$

$\text{Arc} \times \pi r^2 = \text{Area} \times \pi D$

$\text{Arc} = \frac{\text{Area} \times \pi D}{\pi r^2}$ **1**

$\text{Arc} = \frac{210 \times \pi \times 28}{\pi \times 14^2}$ **1**

$\text{Arc} = 30 \text{ cm}$ **1**

7. $\frac{\text{Sector Area}}{\pi r^2} = \frac{\text{angle}}{360}$

$\frac{60}{\pi r^2} = \frac{80}{360}$ **1**

$80 \times \pi r^2 = 60 \times 360$

$r^2 = \frac{60 \times 360}{80 \times \pi}$ **1**

$r = \sqrt{\frac{60 \times 360}{80 \times \pi}}$ **1**

$= 9.270\ldots$

$= 9.3 \text{ cm}$ **1**

8. $\frac{\text{Sector Area}}{\pi r^2} = \frac{\text{angle}}{360}$

$\text{Sector Area} = \frac{140}{360} \times \pi \times 5^2$ **1,1**

$= 30.5 \text{ cm}$ **1**

$\text{Percentage} = \frac{30.5}{360} \times 100$

$= 65\%$ **1**

9. $\frac{\text{Small Sector Area}}{\pi r^2} = \frac{\text{angle}}{360}$

$\text{Small Sector Area} = \frac{78}{360} \times \pi \times 8^2$ **1,1**

$= 43.563$

$\frac{\text{Large Sector Area}}{\pi r^2} = \frac{\text{angle}}{360}$

$\text{Large Sector Area} = \frac{78}{360} \times \pi \times 12^2$ **1,1**

$= 98.017$

$\text{Necklace Area} = 98.017 - 43.563$

$= 54.454\ldots$

$= 54.5 \text{ cm}$ **1**

10. $\frac{\text{Sector Area}}{\pi r^2} = \frac{\text{angle}}{360}$

$\text{Sector Area} = \frac{125}{360} \times \pi \times 5^2$ **1,1**

$= 27.27 \text{ cm}^2$ **1**

$\text{Area of Triangle} = \frac{1}{2} ab \sin C$

$= \frac{1}{2} 5 \times 5 \sin 125$

$= 10.239 \text{ cm}^2$ **1**

$\text{Upper Area} = 27.27 - 10.239$

$= 17.03 \text{ cm}^2$ **1**

Chapter 11
3D Solids - Volume & Surface Area
11D Exam Style Questions

1. $V_{cylinder} = \pi \times 5^2 \times 30$

$= 2356.19$ **1**

$V_{sphere} = \frac{4}{3} \times \pi \times 5^3$

$= 523.6$ **1**

$V_{total} = V_{cylinder} + V_{hemisphere}$

$= 2356.19 + 261.8$ **1**

$= 2617.99 \text{ cm}^3$ **1**

$= 2620 \text{ cm}^3$ **1**

2. $V_{larger\ pyramid} = \frac{1}{3} \times 20^2 \times 37$

$= 4933.33$ **1**

$V_{smaller\ pyramid} = \frac{1}{3} \times 6^2 \times 13$

$= 156$ **1**

$V_{total} = V_{larger} - V_{smaller}$

$= 4933.33 - 156$ **1**

$= 4777.33 \text{ cm}^3$ **1**

$= 4780 \text{ cm}^3$ **1**

3. $V_{cylinder} = \pi \times 10^2 \times 38$

$= 11938.05$ **1**

$V_{cone} = \frac{1}{3} \times \pi \times 10^2 \times 37$

$= 3874.63$ **1**

$V_{total} = V_{cylinder} + 2 \times V_{cone}$

$= 11938.05 + 2 \times 3874.63$ 1

$= 19687.31 \text{ cm}^3$ 1

$= 19\,700 \text{ cm}^3$ 1

4. $V_{cube} = 17^3$

$= 4913$

$V_{sphere} = \frac{4}{3} \times \pi \times 7.5^3$

$= 1767.15$ 1

$V_{total} = V_{cube} - V_{hemisphere}$

$= 4913 - 883.575$ 1

$= 4029.425 \text{ cm}^3$ 1

$= 4029.4 \text{ cm}^3$ 1

5. $V_{sphere} = \frac{4}{3} \times \pi \times 15^3$

$= 14137.166...$ 1

$V_{hemisphere} = \frac{13137.17}{2}$

$= 7068.583...$ 1

$7068.58 = \pi \times 49 \times h$ 1,1

$h = 45.918... = 45.9 \text{ cm}$ 1

6. $V_{larger\ cylinder} = \pi \times 46^2 \times 70$

$= 465\,332.7$ 1

$V_{smaller\ cylinder} = \pi \times 42^2 \times 70$

$= 387\,923.86$ 1

$V_{total} = V_{larger} - V_{smaller}$

$= 465\,332.7 - 387\,923.86$ 1

$= 77\,408.84 \text{ cm}^3$ 1

7. $V_{cylinder} = \pi \times 6^2 \times 28$

$= 3166.73$ 1

$V_{sphere} = \frac{4}{3} \times \pi \times 6^3$

$= 904.78$ 1

$V_{total} = V_{cylinder} + V_{sphere}$

$= 3166.73 - 904.78$ 1

$= 4071.5 \text{ cm}^3$ 1

8. $V_{larger\ cone} = \frac{1}{3} \times \pi \times 18^2 \times 24$

$= 8143.01$ 1

$V_{smaller\ cone} = \frac{1}{3} \pi \times 9^2 \times 16$

$= 1357.17$ 1

$V_{total} = V_{larger} - V_{smaller}$

$= 8143.01 - 1357.17$ 1

$= 6785.84 \text{ cm}^3$ 1

$= 6790 \text{ cm}^3$ 1

9. $V_{larger\ cone} = \frac{1}{3} \times \pi \times 15^2 \times 29$

$= 6832.96$ 1

$V_{smaller\ cone} = \frac{1}{3} \times \pi \times 8.5^2 \times 20$

$= 1513.2$ 1

$V_{total} = V_{larger} - V_{smaller}$

$= 6832.96 - 1513.2$ 1

$= 5319.76$

$= 5319.76 \text{ cm}^3$ 1

10. Height of cone $= \sqrt{18^2 - 6^2}$ 1

$H = 17 \text{ cm}$ 1

$V_{cone} = \frac{1}{3} \times \pi \times 6^2 \times 17$ 1

$= 640.88$ 1

$= 640$ 1

Chapter 12
The Straight Line
12D Exam Style Questions

1. $(-7, 5)$ $(-3, 25)$
x_1, y_2 x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$m = \frac{25 - 5}{-3 - (-7)}$

$m = \frac{20}{4}$

$m = 5$

$a = -7, b = 5, m = 5$

$y - b = m(x - a)$

$y - 5 = 5(x + 7)$ 1,1

$y - 5 = 5x + 35$

$y = 5x + 40$ 1

2. $(-4, 6)$ $(4, 8)$
x_1, y_2 x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$a = 4, b = 8, m = \frac{1}{4}$

$m = \frac{8-6}{4-(-4)}$

$m = \frac{2}{8}$

$m = \frac{1}{4}$

$y - b = m(x - a)$

$y - 8 = \frac{1}{4}(x - 4)$ **1,1**

$4y - 32 = x - 4$

$4y = x + 28$ or $y = \frac{1}{4}x + 7$ **1**

3. G(−2, 7) x_1, y_2 H(3, −3) x_2, y_2

$m_{GH} = \frac{y_2 - y_1}{x_2 - x_1}$

$m_{GH} = \frac{-3-7}{3-(-2)}$

$m_{GH} = \frac{-10}{5}$

$m_{GH} = -2$

$a = 3, b = -3, m = -2$

$y - b = m(x - a)$

$y + 3 = -2(x - 3)$ **1,1**

$y + 3 = -2x + 6$

$y = -2x + 3$ **1**

4. M(−2, 3) x_1, y_2 N(8, 5) x_2, y_2

$m_{MN} = \frac{y_2 - y_1}{x_2 - x_1}$

$m_{MN} = \frac{5-3}{8-(-2)}$

$m_{MN} = \frac{2}{10}$

$m_{MN} = \frac{1}{5}$

$a = 8, b = 5, m = \frac{1}{5}$

$y - b = m(x - a)$

$y - 5 = \frac{1}{5}(x - 8)$ **1,1**

$5y - 25 = x - 8$

$5y = x + 17$ or $y = \frac{1}{5}x + \frac{17}{5}$ **1**

5. $6x - 3y - 7 = 0$

$6x - 7 = 3y$

$3y = 6x - 7$

$y = 2x - \frac{7}{2}$ gradient = 2 **1,1**

6. $2y - 5x = 4$

$2y = 5x + 4$

$y = \frac{5}{2}x + 2$ gradient = $\frac{5}{2}$ **1,1**

7. $8x + 5y + 10 = 0$

when $x = 0$, $8(0) + 5y + 10 = 0$ or when $y = 0$, $8x + 5(0) + 10 = 0$ **1**

$5y = -10$ $8x = -10$

$y = -2$ $x = -\frac{5}{4}$

(0, −2) $(-\frac{5}{4}, 0)$ **1,1**

8. $2y - 3x = 18$

when $x = 0$, $2y - 3(0) = 18$ or when $y = 0$, $2(0) - 3x = 18$ **1**

$2y = 18$ $-3x = 18$

$y = 9$ $x = -6$

(0, 9) (−6, 0) **1,1**

9. Parallel means same gradient so gradient = 4 **1**

$a = 2, b = 3, m = 4$

$y - b = m(x - a)$

$y - 3 = 4(x - 2)$ **1**

$y - 3 = 4x - 8$

$y = 4x - 5$ **1**

10. $2y = x + 3$

$y = \frac{1}{2}x + \frac{3}{2}$

Parallel means same gradient, $m = \frac{1}{2}$ **1**

$a = -1, b = 6, m = \frac{1}{2}$

$y - b = m(x - a)$

$y - 6 = \frac{1}{2}(x + 1)$ **1**

$2y - 12 = x + 1$

$2y = x + 13$ or $y = \frac{1}{2}x + \frac{13}{2}$ **1**

Chapter 13
Functions
13D Exam Style Questions

1. $f(x) = 4x - 9$

$f(2) = 4(2) - 9$ **1**

$= 8 - 9$

$= -1$ **1**

2. $f(x) = 6 - x^2$

$f(-2) = 6 - (-2)^2$ **1**

$= 6 - 4$

$= 2$ **1**

3. $f(x) = (x - 7)^2$

$f(5) = (5 - 7)^2$ 1

$= (-2)^2$

$= 4$ 1

4. $f(x) = 3x^3 - 5$

$f(-2) = 3(-2)^3 - 5$ 1

$= 3(-8) - 5$

$= -24 - 5$

$= -29$ 1

5. $12a - 3 = -39$ 1

$12a = -36$

$a = -\frac{36}{12}$

$a = -3$ 1

6. $f(90) = 1 + \cos(2 \times 90)$ 1

$= 1 + \cos(180)$

$= 1 + (-1)$

$= 0$ 1

7. $g(x) = \frac{3}{\sqrt{x+1}}$

$g(6) = \frac{3}{\sqrt{6+1}}$ 1

$= \frac{3}{\sqrt{7}}$

$= \frac{3}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}}$

$= \frac{3\sqrt{7}}{7}$ 1

8. $f(x) = x^3 - 3x$

$f(-2) = (-2)^3 - 3(-2)$ 1

$= -8 + 6$

$= -2$ 1

9. $2 - 4a = 14$ 1

$-4a = 12$

$a = -3$ 1

10. $f(x) = \frac{6}{x^2 + 1}$

$f(3) = \frac{6}{3^2 + 1}$ 1

$= \frac{6}{10}$

$= \frac{3}{5}$ 1

Chapter 14
Solving Equations 1 - Equations and Inequations
14D Exam Style Questions

1. $\frac{(x+2)}{3} + \frac{(x+4)}{4} = 3$

$4(x + 2) + 3(x + 4) = 36$ 1

$4x + 8 + 3x + 9 = 36$

$7x + 19 = 36$ 1

$x = \frac{19}{7}$ 1

2. $4(f - 1) - 2(5f - 1) > 3$

$4f - 4 - 10f + 2 > 3$ 1

$-6f - 2 > 3$

$-6f > 5$ 1

$f < -\frac{5}{6}$ 1

3. $\frac{(x+1)}{2} + \frac{(x-1)}{3} \leqslant 1$

$3(x + 1) + 2(x - 1) \leqslant 6$ 1

$3x + 3 + 2x - 2 \leqslant 6$

$5x + 1 \leqslant 6$

$5x \leqslant 5$ 1

$x \leqslant 1$ 1

4. $\frac{u}{5} - \frac{(3u-1)}{2} = 4$

$2u - 5(3u - 1) = 40$ 1

$2u - 15u + 5 = 40$

$-13u = 35$ 1

$u = -\frac{35}{13}$ 1

5. $5 - 2(3z + 6) = 3(z + 1)$

$5 - 6z - 12 = 3z + 3$ 1

$-7 - 6z = 3z + 3$

$-7 - 3 = 3z + 6z$

$-10 = 9z$

$-9z = 10$ 1

$z = -\frac{10}{9}$ 1

6. $\frac{m}{5} = \frac{(1-2m)}{2}$

$2m = 5(1 - 2m)$ 1

$2m = 5 - 10m$

$12m = 5$ 1

$m = \frac{5}{12}$ 1

7. $2x - \frac{(5x-1)}{2} \geqslant 5$

$4x - (5x - 1) \geqslant 10$ 1

$4x - 5x + 1 \geqslant 10$

$-x + 1 \geqslant 10$

$-x \geqslant 9$ 1

$x \leqslant -9$ 1

8. $\frac{5}{x} + 1 = 4$

$5 + x = 4x$ 1

$5 = 3x$

$3x = 5$ 1

$x = \frac{5}{3}$ 1

9. Area of Triangle$_1$ $= \frac{1}{2}x(x-2)$ 1

Area of Triangle$_2$ $= \frac{1}{2}(x-3)(x+3)$

$\frac{1}{2}x(x-2) = \frac{1}{2}(x-3)(x+3)$ 1

$x(x-2) = (x-3)(x+3)$ 1

$x^2 - 2x = x^2 - 9$

$-2x = -9$

$x = \frac{9}{2}$ 1

10. Perimeter of Rectangle $= 2(4x - 1) + 2(x + 5)$ 1

Perimeter of Square $= 4(3x)$

$2(4x - 1) + 2(x + 5) = 4(3x)$ 1

$(4x - 1) + (x + 5) = 2(3x)$ 1

$4x - 1 + x + 5 = 6x$

$5x + 4 = 6x$

$4 = x$

$x = 4$ 1

Chapter 15
Equations 2 - Simultaneous Linear Equations
15D Exam Style Questions

1. $2x + 3y = 14$ [A] × 5

$5x + 7y = 36$ [B] × 2

$10x + 15y = 70$ [C]

$10x + 14y = 72$ [D] 1

[C] − [D]

$y = -2$ 1

$2x + 3(-2) = 14$

$2x - 6 = 14$

$2x = 20$

$x = 10$ 1

2. $5f + 3b = 3850$ [A] × 2 **1**

$2f + 5b = 3820$ [B] × 5 **1**

$10f + 6b = 7700$ [C]

$10f + 25b = 19\,100$ [D] **1**

[D] − [C]

$19b = 11\,400$

$b = 600$ **1**

$5f + 3(600) = 3850$

$5f + 1800 = 3850$

$5f = 2050$

$f = 410$ **1**

Basketball = 600g, football = 410g **1**

3. $4x + 2y = -34$ [A] × 3

$3x - 3y = -12$ [B] × 4

$12x + 6y = -102$ [C]

$12x - 12y = -48$ [D] **1**

[C] − [D]

$18y = -54$

$y = -3$ **1**

$4x + 2(-3) = -34$

$4x - 6 = -34$

$4x = -28$

$x = -7$ **1**

4. $2x + 6y = 13$ [A] × 5

$5x - 2y = 24$ [B] × 2

$10x + 30y = 65$ [C]

$10x - 4y = 48$ [D] **1**

[C] − [D]

$34y = 17$

$y = 0.5$ **1**

$2x + 6(0.5) = 13$

$2x + 3 = 13$

$2x = 10$

$x = 5$ **1**

5. $7x + 3y = 12$ [A] × 2

$5x - 2y = -8$ [B] × 3

$14x + 6y = 24$ [C]

$15x - 6y = -24$ [D] **1**

[C] + [D]

$29x = 0$

$x = 0$ **1**

$7(0) + 3y = 12$

$3y = 12$

$y = 4$ **1**

6. $6p + 4a = 6.06$ [A] × 5 **1**

$5p + 3a = 4.88$ [B] × 6 **1**

$30p + 20a = 30.3$ [C]

$30p + 18a = 29.28$ [D] **1**

[C] − [D]

$2a = 1.02$

$a = 0.51$ **1**

$6p + 4(0.51) = 6.06$

$6p + 2.04 = 6.06$

$6p = 4.02$

$p = 0.67$ **1**

apple = 51p, pear = 67p **1**

7. $2a + 3c = 22.40$ [A] × 3 **1**

$3a + 4c = 31.80$ [B] × 2 **1**

$6a + 9c = 67.20$ [C]

$6a + 8c = 63.60$ [D] **1**

[C] − [D]

$c = 3.60$ **1**

$2a + 3(3.60) = 22.40$

$2a + 10.80 = 22.40$

$2a = 11.60$

$a = 5.80$ **1**

child = £3.60, adult = £5.80, total = £18.80 **1**

8. $4x + 6y = 1$ [A] × 3

$6x - 8y = 27$ [B] × 2

$12x + 18y = 3$ [C]

$12x - 16y = 54$ [D] 1

[C] − [D]

$34y = -51$

$y = -1.5$ 1

$4x + 6(-1.5) = 1$

$4x - 9 = 1$

$4x = 10$

$x = 2.5$ 1

9. $5x - 4y = 17$ [A] × 3

$2x + 3y = -7$ [B] × 4

$15x - 12y = 51$ [C]

$8x + 12y = -28$ [D] 1

[C] + [D]

$23x = 23$

$x = 1$ 1

$2(1) + 3y = -7$

$2 + 3y = -7$

$3y = -9$

$y = -3$ 1

10. $3x - 7y = -11$ [A] × 2

$2x + 5y = 41$ [B] × 3

$6x - 14y = -22$ [C]

$6x + 15y = 123$ [D] 1

[D] − [C]

$29y = 145$

$y = 5$ 1

$3x - 7(5) = -11$

$3x - 35 = -11$

$3x = 24$

$x = 8$ K(8, 5) 1

Chapter 16
Changing the Subject of a Formula
16D Exam Style Questions

1. $A = \frac{4B - C}{D}$ (B) Multiply by D

$AD = 4B - C$ Add C 1

$AD + C = 4B$ Divide by 4 1

$B = \frac{AD + C}{4}$ 1

2. $t = \frac{1}{3}x^3 + v$ (x) Subtract v

$t - v = \frac{1}{3}x^3$ Multiply by 3 1

$3(t - v) = x^3$ Square root 1

$x = \sqrt[3]{3(t - v)}$ 1

3. $h = \sqrt{\frac{xy}{z}}$ (x) Square each side

$h^2 = \frac{xy}{z}$ Multiply by z 1

$h^2z = xy$ Divide by y 1

$x = \frac{h^2z}{y}$ 1

4. $b = m + \frac{1}{4}pn^2$ (p) Subtract m

$b - m = \frac{1}{4}pn^2$ Multiply by 4 1

$4(b - m) = pn^2$ Divide by n^2 1

$p = \frac{4(b - m)}{n^2}$ 1

5. $B = \sqrt{A - 6CD}$ (C) Square each side

$B^2 = A - 6CD$ Add 6CD 1

$6CD + B^2 = A$ Subtract B^2

$6CD = A - B^2$ Divide by 6D 1

$C = \frac{A - B^2}{6D}$ 1

6. $X = \frac{Z - 7}{E^3}$ (E) Multiply by E^3

$E^3X = Z - 7$ Divide by X 1

$E^3 = \frac{Z - 7}{X}$ Cube root 1

$E = \sqrt[3]{\frac{Z - 7}{X}}$ 1

7. $K = \frac{8e + b^3}{c}$ (b) Multiply by c

$Kc = 8e + b^3$ Subtract 8e 1

$Kc - 8e = b^3$ Square each side 1

$\sqrt[3]{Kc - 8e}$ 1

8. $V = \frac{4}{3}\pi r^3$ (r) Multiply by 3

$3V = 4\pi r^3$ Divide by 4π 1

$r^3 = \frac{3V}{4\pi}$ Cube root 1

$r = \sqrt[3]{\frac{3V}{4\pi}}$ 1

9. $m = \sqrt[3]{n - a}$ (n) Cube each side

$m^3 = n - a$ Add a 1

$n = m^3 + a$ 1

10. $w = \frac{d}{5} + 2b^2$ (d) Subtract $2b^2$

$w - 2b^2 = \frac{d}{5}$ Multiply by 5 1

$d = 5(w - 2b^2)$ 1

Chapter 17
Quadratic Functions and Graphs
17D Exam Style Questions

1. $y = 3(x - 2)^2 + 1$

Turning point: $x = 2$, $y = 1$

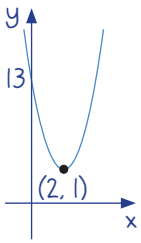
Turning point is (2, 1) 1

When $x = 0$, $y = 3(0 - 2)^2 + 1$

$= 12 + 1$

$= 13$

y-intercept is (0, 13) 1



1

2. $y = x^2 + 4x - 2$

$y = (x + 2)^2 - 4 - 2$ 1

$y = (x + 2)^2 - 6$ 1

3. $x = -3$ 1

$y = -(x + a)^2 + b$

$y = -(x + 3)^2 + 15$

$a = 13$ and $b = 15$ 1,1

4. $a = 7$, $b = -10$, $c = 3$

$b^2 - 4ac = (-10)^2 - 4(7)(3)$ 1

$= 100 - 84$

$= 16$

$b^2 - 4ac > 0$, therefore there are two real and distinct roots 1

5. $y = (x - 3)(x + 5)$

when $y = 0$: $0 = (x - 3)(x + 5)$

$x = 3$, $x = -5$

Points on x-axis: (3, 0) and (−5, 0) 1

x-value of turning point $= \frac{-5 + 3}{2}$

$= -1$

When $x = -1$, $y = ((-1) - 3)((-1) + 5)$

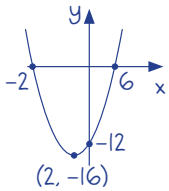
$= -16$

Turning point: (−1, −16) 1

When $x = 0$, $y = (0 - 3)(0 + 5)$

$= -15$

y-intercept: (0, −15)



1

6. $a = 3$, $b = -5$, $c = 1$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(1)}}{2(3)}$ 1

$x = \frac{5 \pm \sqrt{13}}{6}$ 1

$x = 1.43, 0.23$ 1

7. $h(t) = -t^2 + 6t$

$-t^2 + 6t = 0$ 1

$-t(t - 6) = 0$ 1

$t = 0, 6$ 1

It returns to the ground after 6 seconds 1

8. $a = 1, b = -6, c = 7$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(7)}}{2(1)}$ 1

$x = \frac{6 \pm \sqrt{8}}{2}$ 1

$x = \frac{6 \pm 2\sqrt{2}}{2}$ 1

$x = 3 \pm \sqrt{2}$ 1

9. Volume of Pyramid $= \frac{1}{3}Ah$

$18 = \frac{1}{3}(x + 1)^2(6)$ 1

$18 = 2(x + 1)^2$

$9 = (x + 1)^2$ 1

$9 = (x + 1)(x + 1)$

$9 = x^2 + 2x + 1$

$0 = x^2 + 2x - 8$

$0 = (x + 4)(x - 2)$

$x = -4, 2$

for the context of this question, x cannot be negative, therefore $x = 2$ cm 1

10. at A, $x = 0$: $y = -(0 + 2)(0 - 4)$

$= 8$ 1

Points A and B have y-coordinate of 8

$8 = -(x + 2)(x - 4)$

$8 = -(x^2 - 2x - 8)$

$8 = -x^2 + 2x + 8$

$0 = -x^2 + 2x$

$0 = -x(x - 2)$

$x = 0, 2$

B is (2, 8) 1

Chapter 18
Properties of Shapes
18D Exam Style Questions

1. Angle BOD = 34° 1

Angle OEC = 73° 1

Shaded angle BEC = 107° 1

2. Angle OHD = 30° 1

Angle GDH = 90°

Angle OGD = 60° 1

Shaded angle FGA = 60° 1

3. Angle ABC = 90°

Angle DAB = 70° 1

Angle CAD = 70° – 40°

Shaded angle CAD = 30° 1

4. Angle at octagon centre = 45° 1

Octagon interior angle = 67.5° x 2 1

Angle FGE = 22.5° 1

Shaded angle BGE = 67.5° 1

5. Angle ABC = 90°

Angle ACB = 53° 1

Shaded angle DOC = 53° 1

6. Angle OAB and AOB = 32° 1

Angle ABO = 116°

Angle OBC and BCO = 64° 1

Angle BOC = 52°

Shaded angle DOC = 96° 1

7. Angle at pentagon centre = 45° 1

Pentagon interior angle = 67.5° × 2 1

Shaded angle OEA = 108° − 60°

= 48° 1

8. Angle ABD = 90° 1

Angle OCD = 90° 1

9. Angle ABD = 90°

Angle ADB = 22° 1

Angle DBC = 22° 1

Shaded angle CDB = 55° 1

10. Angle CBA = 22° + 25°

= 47° 1

Reflex angle AOC = 360° − (47 + 22 + 25)° 1

Shaded reflex angle AOC = 266° 1

Chapter 19
Pythagoras Theorem
19D Exam Style Questions

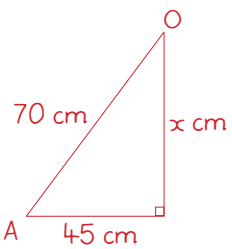
1.

Shortest Sides	Longest Side	
$9^2 + 40^2$	41^2	1
$= 81 + 1600$	$= 1681$	1
$= 1681$		

$9^2 + 40^2 = 41^2$ 1

Therefore, by the converse of Pythagoras' Theorem, triangle ABC is right angled 1

2.



$x^2 = 70^2 - 45^2$ 1,1

$x^2 = 4900 - 2025$

$x^2 = 2875$

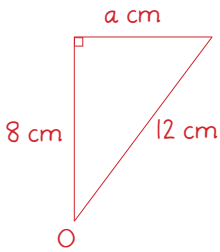
$x = \sqrt{2875}$

$x = 53.619...$ 1

height (h) = 70 + 53.619...

= 123.6 cm 1

3.



$a^2 = 12^2 - 8^2$ 1,1

$a^2 = 144 - 64$

$a^2 = 80$

$a = \sqrt{80}$

$a = 8.944...$ 1

chord (x) = 2(8.944...)

= 17.9 cm 1

4. $CD^2 = 23^2 + 8^2 + 9^2$ 1,1

$CD^2 = 529 + 64 + 81$

$CD^2 = 674$

$CD = \sqrt{674}$

$CD = 25.961...$

CD = 26 cm 1

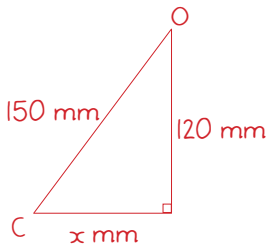
5.

Shortest Sides	Longest Side	
$260^2 + 195^2$	323^2	1
$= 67600 + 38025$	$= 104329$	1
$= 105625$		

$260^2 + 195^2 \neq 323^2$ 1

Therefore, as triangle is NOT right angled, start is not directly west of checkpoint K. 1

6.



$x^2 = 150^2 - 120^2$ 1,1

$x^2 = 22500 - 14400$

$x^2 = 8100$

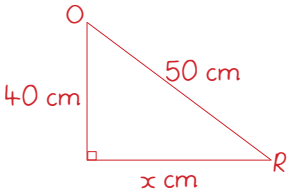
$x = \sqrt{8100}$

$x = 90$ 1

chord (CD) = 2(90)

= 180 mm 1

7.



$x^2 = 50^2 - 40^2$ **1,1**

$x^2 = 2500 - 1600$

$x^2 = 900$

$x = \sqrt{900}$

$x = 30$ **1**

length = 50 + 30

= 80 cm **1**

8. $length^2 = 90^2 + 60^2 + 50^2$ **1,1**

$length^2 = 8100 + 3600 + 2500$

$length^2 = 14\ 200$

$length = \sqrt{14\ 200}$

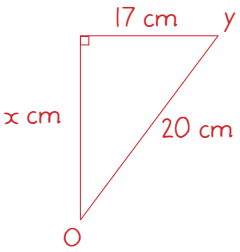
length = 119.1631...

length = 1.19 metres **1**

The box in NOT big enough to fit the post as,

$90^2 + 50^2 + 60^2 < 130^2$ **1**

9.



$x^2 = 20^2 - 17^2$ **1,1**

$x^2 = 400 - 289$

$x^2 = 111$

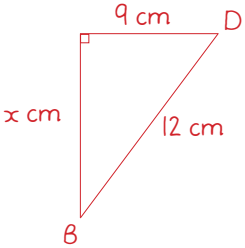
$x = \sqrt{111}$

$x = 10.535...$ **1**

height = 20 + 10.535...

= 30.5 cm **1**

10.



$x^2 = 12^2 - 9^2$ **1,1**

$x^2 = 144 - 81$

$x^2 = 63$

$x = \sqrt{63}$

$x = 7.937...$ **1**

length = 2(12) + 2(7.937....)

= 39.9 cm **1**

Chapter 20
Similarity
20D Exam Style Questions

1. Linear SF $= \frac{\text{new length}}{\text{old length}}$

LSF $= \frac{10}{14}$

$= \frac{5}{7}$ **1**

Area SF $= \left(\frac{5}{7}\right)^2$

$= \frac{25}{49}$ **1**

Small bonnet area $= \frac{25}{49} \times 29.4$

$= 15\ cm^2$ **1**

2. Linear SF $= \frac{\text{new length}}{\text{old length}}$

LSF $= \frac{2.4}{7.2}$

$= \frac{1}{3}$ **1**

Volume SF $= \left(\frac{1}{3}\right)^3$

$= \frac{1}{27}$ **1**

Burning time $= \frac{1}{27} \times 13.5$

= 0.5 hours **1**

3. Linear SF $= \frac{\text{new length}}{\text{old length}}$

LSF $= \frac{PT}{QS}$

$= \frac{24}{15}$

$= \frac{8}{5}$ **1**

$TR = \frac{8}{5} \times 16$

= 25.6 cm **1**

TS = 25.6 − 16

= 9.6 cm **1**

4. Linear SF $= \frac{\text{new length}}{\text{old length}}$

LSF $= \frac{3.2}{8}$

$= \frac{2}{5}$ 1

Area SF $= \left(\frac{2}{5}\right)^2$

$= \frac{4}{25}$ 1

Cost $= \frac{4}{25} \times 112.50$

$= £18$ 1

5. Linear SF $= \frac{\text{new length}}{\text{old length}}$

VSF $= \frac{27}{8}$

Linear SF $= \sqrt[3]{\frac{27}{28}}$

$= \frac{3}{2}$ 1

Height $= \frac{3}{2} \times 12$

$= 18$ cm 1

6. Linear SF $= \frac{\text{new length}}{\text{old length}}$

LSF $= \frac{70}{50}$

$= \frac{7}{5}$ 1

Area SF $= \left(\frac{7}{5}\right)^2$

$= \frac{49}{25}$ 1

Large Price $= \frac{49}{25} \times 50.75$

$= £99.47$ 1

7. Linear SF $= \frac{\text{new length}}{\text{old length}}$

LSF $= \frac{3.6}{2.4}$

$= \frac{3}{2}$ 1

Area SF $= \left(\frac{3}{2}\right)^2$

$= \frac{9}{4}$ 1

Cost $= \frac{9}{4} \times 1250$

$= £2812.50$ 1

No, the cost is not correct, it should be £2812.50, not £3200. 1

8. Volume $= \frac{1}{3}$ Ah

$= \frac{1}{3} \times 3^2 \times 12$

$= 36\ cm^3$ 1

Volume SF $= \frac{\text{new volume}}{\text{old volume}}$

VSF $= \frac{4}{3} \div \frac{36}{1}$

$= \frac{4}{3} \times \frac{1}{36}$

$= \frac{4}{108}$

$= \frac{1}{27}$ 1

Linear SF $= \sqrt[3]{\frac{1}{27}}$

$= \frac{1}{3}$ 1

Height $= \frac{1}{3} \times 12$

$= 4$ cm

Breadth $= \frac{1}{3} \times 3$

$= 1$ cm

Length $= \frac{1}{3} \times 3$

$= 1$ cm 1

9. Area SF $= \frac{\text{new area}}{\text{old area}}$

ASF $= \frac{12.8}{9.8}$ 1

Linear SF $= \left(\frac{12.8}{9.8}\right)^2$

$= \frac{8}{7}$ 1

Length $= \frac{8}{7} \times 4$

$= 4.57$ cm 1

10. Area $= \frac{1}{2}$ ab sin C

$= \frac{1}{2} \times 5 \times 8 \sin 30$ 1

$= 10$ m 1

Linear SF $= \frac{\text{new length}}{\text{old length}}$

LSF $= \frac{12}{5}$ 1

Area SF $= \left(\frac{12}{5}\right)^2$

$= \frac{144}{25}$ 1

Total Area $= \frac{144}{25} \times 10$

$= 57.6 \text{ m}^2$ 1

Chapter 21
Trigonometric Functions
21D Exam Style Questions

1. $a = 4$ 1

2 waves between 0 and 360°

$b = 2$ 1

2. $11 \tan x° - 5 = 4$

$11 \tan x° = 9$

sin ✓	all
tan ✓	cos

$\tan x° = \frac{9}{11}$ 1

Acute angle: $\tan^{-1}\left(\frac{9}{11}\right) = 39.3°$

First value = 39.3° 1

Second value = 180 + 39.3°

$= 219.3°$ 1

3. graph has been horizontally shifted right by 30°

90° + 30° = 120° 1

A(120°, 4) 1

4. $\frac{\sin x°}{\tan x°}$ using $\tan x° = \frac{\sin x°}{\cos x°}$

$= \frac{\sin x°}{1} \div \frac{\sin x°}{\cos x°}$ 1

$= \frac{\sin x°}{1} \times \frac{\cos x°}{\sin x°}$

$= \cos x°$ 1

5. $37 - 32 \cos t = 63$ 1

$-32 \cos t = 26$

sin ✓	all
tan ✓	cos

$\cos t = -\frac{26}{32}$ 1

Acute angle: $\cos^{-1}\left(\frac{26}{32}\right) = 35.7°$

First value = 180 − 35.7°

$= 144.3°$ 1

Second value = 180 + 35.7°

$= 215.7°$ 1

6. $a = 2$ 1

graph has been horizontally shifted right by 90°

$b = -90°$ 1

7. $13 \cos x° + 5 = -7$

$13 \cos x° = -12$

sin ✓	all
tan ✓	cos

$\cos x° = -\frac{12}{13}$ 1

Acute angle: $\cos^{-1}\left(\frac{12}{13}\right) = 22.6°$

First value = 180 − 22.6°

$= 157.4°$ 1

Second value = 180 + 35.7°

$= 202.6°$ 1

8. $5 \sin 2 x° - 3$ as $\sin 2 x° + \cos 2 x° = 1$

$= 5 (1 - \cos^2 x°) - 3$ $\sin^2 x° = 1 - \cos^2 x°$ 1

$= 5 - 5 \cos^2 x° - 3$

$= 2 - 5 \cos^2 x°$ 1

9. $a = -2$ 1

$b = 2$ 1

$c = -0.5$ 1

10. $54 \sin x° + 23 = 6$

$54 \sin x° = -17$

sin ✓	all
tan ✓	cos ✓

$\sin x° = -\frac{17}{54}$ 1

Acute angle: $\sin^{-1}\left(\frac{17}{54}\right) = 18.3°$

First value = 180 + 18.3°

$= 198.3°$ 1

Second value = 360 − 18.3°

$= 341.7°$ 1

Chapter 22
Triangle Trigonometry
22D Exam Style Questions

1. $\frac{x}{\sin 28} = \frac{40}{\sin 104}$ **1**

$x = \frac{40 \sin 28}{\sin 104}$ **1**

$x = 19.353...$ **1**

$\frac{h}{\sin 48} = \frac{19.4}{\sin 90}$ **1**

$h = \frac{19.4 \sin 48}{\sin 90}$

$h = 14.417...$

$h = 14.4$ cm **1**

2. $\frac{a}{\sin 35} = \frac{30}{\sin 24}$ **1**

$a = \frac{30 \sin 35}{\sin 24}$ **1**

$a = 42.305...$ **1**

$\frac{x}{\sin 59} = \frac{42.3}{\sin 90}$ **1**

$x = \frac{42.3 \sin 59}{\sin 90}$

$x = 36.258...$

$x = 36.3$ cm **1**

3. Area $= \frac{1}{2} \times 5.8 \times 5.8 \times \sin 34$ **1**

Area $= 9.405...$

Area $= 9.4$ cm^2 **1**

4. $AC^2 = 48^2 + 55^2 - 2 \times 48 \times 55 \times \cos 140$ **1,1**

$AC^2 = 9373.714...$

$AC = 96.871...$

$AC = 96.8$ km **1**

5. $\frac{x}{\sin 31} = \frac{6}{\sin 18}$ **1**

$x = \frac{6 \sin 31}{\sin 18}$ **1**

$x = 10.000...$ **1**

$\frac{AB}{\sin 49} = \frac{10}{\sin 90}$ **1**

$AB = \frac{10 \sin 49}{\sin 90}$

$AB = 7.547...$

$AB = 7.5$ km **1**

6. $\frac{x}{\sin 102} = \frac{70}{\sin 38}$ **1,1**

$x = \frac{70 \sin 102}{\sin 38}$ **1**

$x = 111.214...$ **1**

$x = 110$ km **1**

7. $\frac{x}{\sin 58} = \frac{62}{\sin 74}$ **1**

$x = \frac{62 \sin 58}{\sin 74}$ **1**

$x = 54.697...$

$x = 54.7$ **1**

$\frac{AC}{\sin 48} = \frac{54.7}{\sin 90}$ **1**

$AC = \frac{54.7 \sin 48}{\sin 90}$

$AC = 40.648...$

$AC = 40.6$ m **1**

8. Area $= 8 \times \frac{1}{2} \times 10 \times 10 \times \sin 45$ **1,1**

$= 282.842...$

$= 282.8$ cm^2 **1**

9. $\cos BAD = \frac{59.8^2 + 68.9^2 - 73.1^2}{2 \times 59.8 \times 68.9}$ **1**

$\cos BAD = 0.361...$ **1**

$BAD = \cos^{-1}(0.361...)$

$BAD = 68.802...$

$BAD = 68.8$ cm **1**

Area $= 2 \times \frac{1}{2} \times 59.8 \times 68.9 \times \sin 68.8$ **1**

Area $= 3841.438...$ **1**

Area $= 3840$ cm^2 **1**

10. Area $= \frac{1}{2} \times 9 \times 9 \times \sin 142$ **1**

$= 24.934...$

$= 24.9\ cm^2$ 1

Chapter 23
Vectors
23D Exam Style Questions

1. $\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$

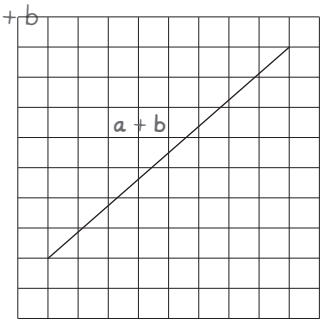
$= \begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} -8 \\ 1 \end{pmatrix}$ 1

$= \begin{pmatrix} -6 \\ -2 \end{pmatrix}$ 1

$\overrightarrow{MC} = \frac{1}{2}\overrightarrow{AC}$

$= \begin{pmatrix} -3 \\ -1 \end{pmatrix}$ 1

2. $a + b$



1

3. $3a + 5b$

$= 3\begin{pmatrix} 3 \\ 4 \\ -2 \end{pmatrix} + 5\begin{pmatrix} 1 \\ 4 \\ -1 \end{pmatrix}$ 1

$= \begin{pmatrix} 9 \\ 12 \\ -6 \end{pmatrix} + \begin{pmatrix} 5 \\ 20 \\ -5 \end{pmatrix}$

$= \begin{pmatrix} 14 \\ 32 \\ -11 \end{pmatrix}$ 1

4. $f = \begin{pmatrix} -2 \\ 6 \\ 2 \end{pmatrix}$

$|f| = \sqrt{(-2)^2 + 6^2 + 2^2)}$ 1

$= \sqrt{(4 + 36 + 4)}$

$= \sqrt{44}$ 1

$= 2\sqrt{11}$ 1

5. G is the point (6, 3, 4) 1

$\overrightarrow{AG} = g - a$

$= \begin{pmatrix} 6 \\ 3 \\ 4 \end{pmatrix} - \begin{pmatrix} 2 \\ -1 \\ 0 \end{pmatrix}$

$= \begin{pmatrix} 4 \\ 4 \\ 4 \end{pmatrix}$

$|AG| = \sqrt{4^2 + 4^2 + 4^2)}$ 1

$= \sqrt{48}$ 1

$= 4\sqrt{3}$ 1

6. $\overrightarrow{AD} = \overrightarrow{AC} + \overrightarrow{CD}$

$= v + u$ 1

$\overrightarrow{AG} = \frac{3}{4}\overrightarrow{AD}$ 1

$= \frac{3}{4}(v + u)$ 1

7. $a + b$

$= \begin{pmatrix} 3 \\ 3 \end{pmatrix} - \begin{pmatrix} 5 \\ -1 \end{pmatrix}$ 1

$= \begin{pmatrix} -2 \\ 4 \end{pmatrix}$ 1

8. $b = (b - a) + a$

$= \begin{pmatrix} 1 \\ 4 \\ -1 \end{pmatrix} + \begin{pmatrix} 2 \\ 5 \\ -1 \end{pmatrix}$ 1

$= \begin{pmatrix} 3 \\ 9 \\ -2 \end{pmatrix}$ 1

9. B is the point (9, 0, 0) 1

G is the point (9, 6, 6) 1

10. $\overrightarrow{CB} = \overrightarrow{CA} + \overrightarrow{AB}$

$= -v + w$ 1

$\overrightarrow{CD} = \frac{1}{2}\overrightarrow{CB}$

$= \frac{1}{2}(-v + w)$ 1

$\overrightarrow{AE} = \frac{1}{2}\overrightarrow{AD}$

$= \frac{1}{2}(v + \frac{1}{2}(-v + w))$

$= \frac{1}{2}(v - \frac{1}{2}v + \frac{1}{2}w)$

$= \frac{1}{2}(\frac{1}{2}v + \frac{1}{2}w)$

$= \frac{1}{4}(v + w)$ 1

Chapter 24
Percentages
24D Exam Style Questions

1. 84% = 75 600 1

1% = 75 600 ÷ 84

= 900 1

100% = 90 000 tickets 1

2. $113.5\% = 86.26$ **1**

$1\% = 86.26 \div 113.5$

$= 0.76$ **1**

$13.5\% \quad = £10.26$ **1**

3. $1.11^5 \times 82\,300$ **1,1**

$= 138\,680.29$ **1**

$= £138\,700$ **1**

4. $137\% = 123.30$ **1**

$1\% = 123.30 \div 137$

$= 0.9$ **1**

$100\% = £90$ **1**

5. $0.92^3 \times 18\,470$ **1,1**

$= 14\,382.37$ **1**

$= £14\,400$ **1**

6. $124\% = 31$ **1**

$1\% = 31 \div 124$

$= 0.25$ **1**

$100\% = 25$ biscuits **1**

7. $1.16^4 \times 349\,000$ **1,1**

$= £631\,913.14$ **1**

8. Month 1: $0.93^1 \times 97 = 90.2$ **1**

Month 2: $0.93^2 \times 97 = 83.8953$ **1**

Month 3: $0.93^3 \times 97 = 78.022...$

$= 78$ kg

After three months **1**

9. $80\% = 56$ **1**

$10\% = 56 \div 8$

$= 7$ **1**

$100\% = 70$ questions **1**

10. $120\% = 780$ **1**

$20\% = 780 \div 6$

$= 130$ **1**

$100\% \quad = £650$ **1**

Chapter 25
Fractions
25D Exam Style Questions

1. $3\frac{1}{5} \div \frac{4}{7}$

$= \frac{16}{5} \div \frac{4}{7}$

$= \frac{16}{5} \times \frac{7}{4}$ **1**

$= \frac{28}{5}$ or $5\frac{3}{5}$ **1**

2. $4\frac{1}{3} \times 2\frac{2}{5}$

$= \frac{13}{3} \times \frac{12}{5}$ **1**

$= \frac{13}{1} \times \frac{4}{5}$

$= \frac{52}{5}$ or $10\frac{2}{5}$ **1**

3. $6\frac{1}{6} - 2\frac{1}{4}$

$= 6\frac{2}{12} - 2\frac{3}{12}$ **1**

$= 4\frac{2}{12} - \frac{3}{12}$

$= 3\frac{14}{12} - \frac{3}{12}$

$= 3\frac{11}{12}$ **1**

4. $8\frac{3}{8} + 1\frac{1}{4}$

$= 9\frac{3}{8} + \frac{1}{4}$ **1**

$= 9\frac{3}{8} + \frac{2}{8}$

$= 9\frac{5}{8}$ **1**

5. $\frac{5}{6}\left(\frac{7}{8} - \frac{2}{5}\right)$

$= \frac{5}{6}\left(\frac{35}{40} - \frac{16}{40}\right)$ **1**

$= \frac{5}{6} \times \frac{19}{40}$

$= \frac{1}{6} \times \frac{19}{8}$

$= \frac{19}{48}$ 1

6. $5\frac{2}{3} \div 1\frac{1}{2}$

$= \frac{17}{3} \div \frac{3}{2}$

$= \frac{17}{3} \times \frac{2}{3}$ 1

$= \frac{34}{9}$ or $3\frac{7}{9}$ 1

7. $3\frac{3}{4} \times 1\frac{2}{3}$

$= \frac{15}{4} \times \frac{5}{3}$ 1

$= \frac{5}{4} \times \frac{5}{1}$

$= \frac{25}{4}$ or $6\frac{1}{4}$ 1

8. $7\frac{5}{6} - 3\frac{1}{4}$

$= 4\frac{5}{6} - \frac{1}{4}$

$= 4\frac{10}{12} - \frac{3}{12}$ 1

$= 4\frac{7}{12}$ 1

9. $2\frac{7}{8} + 1\frac{3}{5}$

$= 3\frac{7}{8} + \frac{3}{5}$ 1

$= 3\frac{35}{40} + \frac{24}{40}$

$= 3\frac{59}{40}$

$= 4\frac{19}{40}$ 1

10. $\frac{1}{2}\left(3\frac{1}{4} + \frac{1}{3}\right)$

$= \frac{1}{2}\left(3\frac{3}{12} + \frac{4}{12}\right)$ 1

$= \frac{1}{2}\left(2\frac{15}{12} + \frac{4}{12}\right)$

$= \frac{1}{2} \times 2\frac{19}{12}$

$= \frac{1}{2} \times \frac{43}{12}$

$= \frac{43}{24}$ or $1\frac{19}{24}$ 1

Chapter 26
Statistics
26D Exam Style Questions

1. 15 17 (18) 20 20 | 21 22 (23) 24 25

Q1 Q2 Q3

Median

$Q2 = \frac{21 + 20}{2} = 20.5$ 1

$Q1 = 18$

$Q3 = 23$ 1

$IQR = Q3 - Q1$

$= 23 - 18$

$= 5$ 1

2. $\text{mean} = \frac{4 + 2 + 0 + 1 + 3 + 5 + 6}{7}$

$= \frac{21}{7}$

$= 3$ 1

x	$x - \bar{x}$	$(x - \bar{x})^2$
4	1	1
2	−1	1
0	−3	9
1	−2	4
3	0	0
5	2	9
6	3	4
	$\sum = 0$	$\sum = 28$

1

$s = \sqrt{\frac{28}{7 - 1}}$

$s = \sqrt{\frac{28}{6}}$ 1

$s = 2.2$ 1

3. On average, the numbers of goals scored by the Welsh team was higher than the Scottish team as $4 > 3$. 1

The numbers of goals scored by the Scottish team was more consistent than the Welsh team as 2.2 < 5.2. 1

4. mean $= \frac{2+5+3+8+7+6+4}{7}$

$= \frac{35}{7}$

$= 5$ 1

x	$x - \bar{x}$	$(x - \bar{x})^2$
2	−3	9
5	0	0
3	−2	4
8	3	9
7	2	4
6	1	1
4	−1	1
	$\sum = 0$	$\sum = 28$

1

$s = \sqrt{\frac{28}{7-1}}$ 1

$s = \sqrt{\frac{28}{6}}$

$s = \sqrt{\frac{14}{3}}$ 1

5. 3 25 | 60 67 | 72 75 | 78 80

Q1 Q2 Q3

Median

$Q2 = \frac{67+72}{2} = 69.5$ 1

$Q1 = \frac{25+60}{2} = 42.5$

$Q3 = \frac{75+78}{2} = 76.5$ 1

$IQR = Q3 - Q1$

$= 76.5 - 42.5$

$= 34$ 1

6. On average, the customer age was younger on Saturday than on Monday as 45 < 69.5. 1

The age of customers was less varied on Saturday compared to Monday as 22 < 34. 1

7. mean $= \frac{182+198+204+186+195}{5}$

$= \frac{965}{5}$

$= 193$ 1

x	$x - \bar{x}$	$(x - \bar{x})^2$
182	−11	121
198	5	25
204	11	121
186	−7	49
195	2	4
	$\sum = 0$	$\sum = 320$

$s = \sqrt{\frac{320}{5-1}}$

$s = \sqrt{\frac{320}{4}}$ 1

$s = 8.9$ 1

8. On average, the heights of the players was higher for the men's team than women's as 193 > 183. 1

The heights of players was less varied in the women's team compared to the men's team as 2.1 < 8.9. 1

9. 8 15 | 16 18 | 18 19 | 22 30

Q1 Q2 Q3

Median

$Q1 = \frac{15+16}{2} = 15.5$

$Q3 = \frac{19+22}{2} = 20.5$ 1

$IQR = Q3 - Q1$

$= 20.5 - 15.5$

$= 5$ minutes 1

January than in January as 5.2 > 2.2. 1

10. (10.5, 21) and(13.5, 25)

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{25 - 21}{13.5 - 10.5}$

$= \frac{4}{3}$ **1**

$y - b = m(x - a)$

$y - 25 = \frac{4}{3}(x - 13.5)$ **1**

$3y - 75 = 4x - 54$

$3y = 4x + 21$

$3T = 4H + 21$ **1**

when $H = 14$ seconds,

$3T = 4(14) + 21$

$T = 25.7$ s

The estimated time is 25.7 seconds **1**