| | | | |
|---|---|---|---|
| 1 | $60 \times 4$ or $4(a \times 60)$ or $4a \times 60$<br>or $\frac{b}{a} = 60$ or $\frac{4b}{b/60}$<br>or $4b = 240a$ or $\frac{240a}{a}$ | M1 | accept any multiplication signs |
| | 240 | A1 | Condone $\frac{240}{1}$ |
| | **Additional Guidance** | | |
| | Correct answer found by substituting appropriate values for $a$ and $b$ | | M1A1 |
| | Incorrect answer found by substituting appropriate values for $a$ and $b$ | | M0A0 |
| | Award M1 for $60 \times 4$ or 240 in working, either as individual expressions or as part of longer expressions<br>eg $4 \times 60 = 240$, answer $240b$<br>eg $\frac{4 \times 60 \times a}{4b}$ | | <br>M1A0<br>M1A0 |
| | Do not award M1 for 240 within a list of multiples of 60 that continues beyond 240 | | |

| | | | |
|---|---|---|---|
| 2 | $\frac{1(1-4)}{\sqrt{1+3}}$ or $\frac{-3}{\sqrt{4}}$<br>or<br>$\frac{6(6-4)}{\sqrt{6+3}}$ or $\frac{6 \times 2}{\sqrt{9}}$ or $\frac{12}{3}$ or $\frac{4}{1}$ | M1 | oe<br>eg $\frac{1^2 - 1 \times 4}{\sqrt{1+3}}$<br>eg $\frac{6^2 - 6 \times 4}{\sqrt{6+3}}$ |
| | $\frac{-3}{2}$ or $-1\frac{1}{2}$ or $-1.5$<br>or<br>4 | M1dep | |
| | $2\frac{1}{2}$ or $\frac{5}{2}$ or 2.5 | A1 | oe mixed number, fraction or decimal |
| | **Additional Guidance** | | |
| | $\frac{n^2 - 4n}{\sqrt{n+3}}$ with no correct substitution | | M0M0A0 |

| | | | |
|---|---|---|---|
| 3(a) | **Alternative method 1** | | |
| | $(x-3)^2$ | M1 | may be preceded by $y =$ |
| | 3 | A1 | |
| | **Alternative method 2** | | |
| | $(8 = x^2 - 6x + 17$ and) $x^2 - 6x + 9$ $(= 0)$ | M1 | |
| | 3 | A1 | |
| | | | |
| 3(b) | $(x+2)^2 - 4 + b$ or $-4 + b = 8$ | M1 | |
| | 12 | A1 | SC1 12 from $(x-2)^2 - 4 + b$ |

| | | | |
|---|---|---|---|
| 4 | $(f(10) =) 3 \times 10^2 - 4 \times 10 + 8$ or $(f(10) =) 300 - 40 + 8$ or $(f(10) =) 268$ or $(f(5) =) 3 \times 5^2 - 4 \times 5 + 8$ or $(f(5) =) 75 - 20 + 8$ or $(f(5) =) 63$ or $(2f(5) =) 2 \times 63$ or 126 | M1 | |
| | 268 and 126 and No | A1 | |
| | **Additional Guidance** | | |
| | | | |

| | | | |
|---|---|---|---|
| **5** | $\frac{y+3}{2} = x$<br>or<br>$x = 2y - 3$ and $x + 3 = 2y$<br>or<br>$2x - 3 = 55$ | M1 | |
| | $\frac{x+3}{2}$<br>or $\frac{55+3}{2}$ | A1 | |
| | $2x^2 - 3$<br>or<br>$2 \times 4^2 - 3$ or $2 \times 16 - 3$ | M1 | |
| | $\frac{55+3}{2} = 29$<br>and<br>$2 \times 4^2 - 3 = 29$ or $2 \times 16 - 3 = 29$ | A1 | |
| | **Additional Guidance** | | |
| | 29 with no working or only from incorrect working | | M0A0M0A0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 6(a) | **Alternative method 1: eliminates $d$** | | |
| | $4c + d = 7$ and $10c + d = 22$ | M1 | oe equations |
| | $(10 - 4)c = 22 - 7$ or $6c = 15$ or $c = 2.5$ | M1dep | oe correct equation in $c$ eg $10c + 7 - 4c = 22$ |
| | $c = 2.5$ and $d = -3$ | A1 | oe fraction or mixed number for $c$ |
| | **Alternative method 2: eliminates $c$** | | |
| | $4c + d = 7$ and $10c + d = 22$ | M1 | |
| | $(10 - 4)d = 70 - 88$ or $6d = -18$ or $d = -3$ | M1dep | oe correct equation in $d$ eg $4\left(\frac{22 - d}{10}\right) + d = 7$ |
| | $c = 2.5$ and $d = -3$ | A1 | oe fraction or mixed number for $c$ |
| | **Alternative method 3: works out the difference or the equation of the function through the points** | | |
| | (difference =) $\frac{22 - 7}{10 - 4}$ or 2.5 | M1 | (gradient =) $\frac{22 - 7}{10 - 4}$ or ($m$ =) 2.5 |
| | $c = 2.5$ | M1dep | oe fraction or mixed number |
| | $c = 2.5$ and $d = -3$ | A1 | oe fraction or mixed number for $c$ |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 7(a) | **Alternative method 1** | | |
| | $L = kD^2$ | M1 | oe equation |
| | $85 = 10^2k$ or $85 = 100k$<br>or $(k =)\ 0.85$ | M1dep | oe<br>implies M2 |
| | $L = 0.85D^2$ | A1 | oe equation |
| | **Alternative method 2** | | |
| | $cL = D^2$ | M1 | oe equation |
| | $85c = 10^2$ or $85c = 100$<br>or $(c =)\ \frac{100}{85}$ | M1dep | oe<br>allow $(c =)$ [1.176, 1.18]<br>implies M2 |
| | $\frac{100}{85}L = D^2$ | A1 | oe equation<br>allow [1.176, 1.18]$L = D^2$ |
| | **Additional Guidance** | | |
| | Condone use of α for up to M1M1A0<br>eg Alt 1<br>$L$ α $kD^2$<br>85 α $100k$<br>$L$ α $0.85D^2$ | | <br><br>M1<br>M1<br>A0 |
| | $L = 0.85D^2$ oe | | M1M1A1 |
| | $L$ α $D^2$ is M0 with no further correct working | | |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 7(b) | **Alternative method 1** If using alt 1 in (a) | | |
| | their $k \times 5^2$ | M1 | oe<br>their $k$ from (a) |
| | 21.25 | A1ft | oe<br>correct or ft their $k \times 5^2$ |
| | **Alternative method 2** If using alt 2 in (a) | | |
| | $5^2 \div$ their $c$ | M1 | oe<br>their $c$ from (a) |
| | 21.25 | A1ft | oe<br>correct or ft $5^2 \div$ their $c$<br>do not follow through an approximated value for $\frac{100}{85}$ |
| | **Additional Guidance** | | |
| | $L$ α 21.25 on answer line | | M1A0 |
| | Alt 2 (a) $1.18L = D^2$ (scores 3 marks in (a))<br>(b) $25 \div 1.18 = 21.19$ | | M1A0 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 8 | $b = 2c$ or $b = 16$<br>or<br>$\frac{a}{b} \times \frac{b}{c} = 3c \times 2$ | M1 | oe eg $\frac{a}{2c} = 3c$ or $\frac{a}{16} = 3c$ |
| | $(a =) 6c^2$<br>or<br>$3 \times 8 \times 2 \times 8$ or $24 \times 16$<br>or<br>$6 \times 8^2$ or $6 \times 64$ | M1dep | oe |
| | 384 | A1 | |
| | **Additional Guidance** | | |
| | $\frac{b}{8} = 2$ | | M0 |
| | $\frac{a}{b} = 24$ | | M0 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 9 (a) | $-1$ | B1 | accept $(-1, \frac{1}{16})$ |
| | **Additional Guidance** | | |
| | $16^{-1} = \frac{1}{16}$ | | B0 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 10 | $x = 2y + 5$ or $x - 5 = 2y$ or $y - 5 = 2x$ or $\frac{y-5}{2}$ | M1 | oe eg $x = 2f^{-1} + 5$ or $f(x) - 5 = 2x$ |
| | $\frac{x-5}{2}$ | A1 | oe eg $\frac{x}{2} - \frac{5}{2}$<br>may be implied eg by $12f^{-1}(x) = 6(x-5)$<br>implied by $\frac{y-5}{2}$ if $\frac{x-5}{2}$ used in subsequent working |
| | Correctly expands<br>$3(2x + 5) - 12 \times$ their $\frac{x-5}{2}$<br>to a linear expression | M1 | $6x + 15 - 6x + 30$ if M1A1<br>their $\frac{x-5}{2}$ must be a function of $x$<br>their $\frac{x-5}{2}$ cannot be $2x + 5$<br>implied by a correct linear expression or value for<br>$3(2x + 5) - 12 \times$ their $\frac{x-5}{2}$ |
| | $\frac{x-5}{2}$ and 45 | A1 | |
| | **Additional Guidance** | | |
| | 45 with no working | | Zero |
| | 45 from wrong working does not score 4 marks – mark the working seen | | |
| | First A1 Condone $y = \frac{x-5}{2}$ or $f = \frac{x-5}{2}$ or $f(x) = \frac{x-5}{2}$ or $x = \frac{x-5}{2}$ | | |
| | For $6x + 15 - 6x + 30$ allow $\frac{12x+30-12x+60}{2}$ but not $6x + 15 - \frac{12x-60}{2}$ | | |
| | $x = 2y + 5$ $\frac{x+5}{2}$<br>$6x + 15 - \frac{12x}{2} - \frac{60}{2}$ (implied by $-15$) | | M1A0<br>M1A0 |
| | $-2x - 5$<br>$6x + 15 + 24x + 60$ (implied by $30x + 75$) | | M0A0<br>M1A0 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 11 | **Alternative method 1** | | |
| | $5^2 + 7 \times 5 - c$ or $60 - c$<br>and<br>$3 \times 5 + d$ or $15 + d$ | M1 | oe |
| | $25 + 35 - c = 15 + d$<br>or $60 - c = 15 + d$<br>or<br>$c = 60 - y$ and $d = y - 15$<br>and $c + d = 60 - y + y - 15$ | M1dep | oe equation with squaring and multiplications correctly completed |
| | 45 | A1 | |
| | **Alternative method 2** | | |
| | $x^2 + 7x - c = 3x + d$<br>or<br>$x^2 + 7x - c - (3x + d) = 0$<br>or $x^2 + 7x - c - 3x - d = 0$<br>or<br>$3x + d - (x^2 + 7x - c) = 0$<br>or $3x + d - x^2 - 7x + c = 0$ | M1 | oe |
| | $(c + d =) x^2 + 7x - 3x$<br>or $(c + d =) x^2 + 4x$<br>and<br>substitutes $x = 5$ | M1dep | oe |
| | 45 | A1 | |
| | **Additional Guidance** | | |
| | Once $c + d = 45$ is seen, ignore further attempts to find values for $c$ or $d$ | | |
| | 45 on answer line with no working or no incorrect working | | M1M1A1 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 12 (a) | **Alternative method 1 – using $k$** | | |
| | $\frac{f(6)}{f(2)}\left(=\frac{36k}{4k}\right)=9$<br>or<br>$f(3)=9k$ | M1 | condone eg $k36$ |
| | $\frac{f(6)}{f(2)}=9$ and $f(3)=9k$<br>and No | A1 | condone $k9$ |
| | **Alternative method 2 – substituting a value for $k$** | | |
| | Identifies a value of $k$ other than 1<br>and<br>correctly evaluates $\frac{f(6)}{f(2)}$ or $f(3)$ | M1 | eg $k=2$<br>and<br>$\frac{f(6)}{f(2)}=9$ or $f(3)=18$ |
| | Identifies a value of $k$ other than 1<br>and<br>correctly evaluates $\frac{f(6)}{f(2)}$ and $f(3)$<br>and No | A1 | eg $k=2$ and $\frac{f(6)}{f(2)}=9$ and $f(3)=18$<br>and No |
| | **Additional Guidance** | | |
| | $9k$ from $\frac{f(6)}{f(2)}$ is M0, but M1 can be awarded if accompanied by $f(3)=9k$ | | |
| | Do not allow 9 from $\frac{36}{4}$ (unless $\frac{36}{4}$ is from $\frac{36k}{4k}$) | | |
| | Do not allow 9 from $\frac{36k^2}{4k^2}$ | | |
| | Students may correctly state that $\frac{f(6)}{f(2)}$ and $f(3)$ are (only) equal when $k=1$<br>This may replace 'No' in their answer, but does not score without $9k$ and 9 | | |
| | Do not allow unprocessed values, eg $6^2$, $2^2$ or $3^2$ | | |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 13 (a) | $4x^2 + 28x + 45 \ (= 0)$ | M1 | must be correct |
| | $(2x + 5)(2x + 9) \ (= 0)$<br>or $(2x + 7)^2 - 49 + 45 \ (= 0)$<br>or $\frac{-28 \pm \sqrt{28^2 - 4 \times 4 \times 45}}{2 \times 4}$<br>or $\frac{-28 \pm \sqrt{64}}{8}$ or $\frac{-28 \pm 8}{8}$<br>or $\frac{-7 \pm \sqrt{4}}{2}$ | M1dep | oe<br>implies first M1 |
| | $(x =) -2.5$ and $(x =) -4.5$ | A1 | oe fraction or decimal<br>SC2 $(x =)$ [–1.63, –1.629] and $(x =)$ [–5.371, –5.37] |
| | **Additional Guidance** | | |
| | SC2 from using $4x^2 + 28x + 35 \ (= 0)$ | | |
| | Trial and improvement with both answers correct and chosen from any list | | M1M1A1 |
| | Trial and improvement with one answer correct | | M0M0A0 |

| Q | Answer | Mark | Comment |
|---|---|---|---|
| 14(a) | **Alternative method 1** | | |
| | $6\left(\frac{3x+9}{5}\right) - 1$ | M1 | oe eg $\frac{18x+49}{5}$ |
| | 17 | A1 | SC1 8.4 oe value |
| | **Alternative method 2** | | |
| | $\frac{3 \times 2 + 9}{5}$ or 3 or g(3) | M1 | oe eg $6 \times 3 - 1$ |
| | 17 | A1 | SC1 8.4 oe value |
| | **Additional Guidance** | | |
| | Answer 17 | | M1A1 |
| | Working out f(2) and g(2) is M0 unless recovered<br>eg1 $\frac{3 \times 2 + 9}{5} = 3$ $\quad 6 \times 2 - 1 = 11$<br>eg2 $3 \times 11 = 33$ | | M0A0<br>M0A0 |
| | 17 followed by further work eg $17 \times 3 = 51$ | | M1A0 |
| | SC1 is for fg(2) | | |

| Q | Answer | Mark | Comment |
|---|---|---|---|
| 14(b) | **Alternative method 1** | | |
| | $\frac{5x-9}{3}$ or $\frac{5y-9}{3}$ or $\frac{5\times 8-9}{3}$ | M1 | oe |
| | $\frac{31}{3}$ or $10\frac{1}{3}$ or 10.3(...) | A1 | |
| | **Alternative method 2** | | |
| | $\frac{3x+9}{5}=8$ | M1 | oe equation |
| | $\frac{31}{3}$ or $10\frac{1}{3}$ or 10.3(...) | A1 | |
| | **Additional Guidance** | | |
| | $\frac{31}{3}$ or $10\frac{1}{3}$ or 10.3(...) | | M1A1 |
| | Ignore conversion attempt after correct answer seen | | |

| Q | Answer | Mark | Comment |
|---|---|---|---|
| 15 (a) | $\frac{\text{their } 28}{\sqrt[3]{2744}}$ or $\frac{\text{their } 28}{14}$ | M1 | oe |
| | 2 | A1ft | ft their equation of the form $H=\frac{k}{\sqrt[3]{L}}$ or $cH=\frac{1}{\sqrt[3]{L}}$ SC1 24.5 |
| | **Additional Guidance** | | |
| | $k=56$ in part (a) then $H=\frac{56}{\sqrt[3]{2744}}$ and $H=4$ | | M1A1ft |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 16(a) | $(k=)\ 21 \times 6$ or $(k=)\ 126$ | M1 | oe<br>may be implied eg $y = \frac{126}{x}$ |
| | 10.5 or $\frac{21}{2}$ | A1 | oe value eg $\frac{126}{12}$<br>ignore units |
| | **Additional Guidance** | | |
| | Ignore simplification or conversion attempt after correct answer seen | | |
| | 10.5 only seen embedded eg $10.5 \times 12 = 126$ | | M1A0 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 16(b) | $21 = A \times \frac{1}{3}$<br>or $(A=)\ 21 \times 3$ or $(A=)\ 63$ | M1 | oe eg $21 = A \times \left(\frac{1}{3}\right)^{\frac{1}{6}\times 6}$<br>implied by $(y=)\ 7$ |
| | $(y=)\ 7$<br>and<br>middle box ticked | A1ft | ft decision using their 10.5 in (a)<br>must have $(y=)\ 7$ |
| | **Additional Guidance** | | |
| | A correct value is sufficient for showing working | | |
| | Decision may be indicated by selecting a box or a statement in the working lines | | |
| | Decision cannot be implied only by an inequality | | |