

5540H/4 Higher Calculator				
Question	Working	Answer	Mark	Notes
1 (a)		$\frac{5}{12}$	2	M1 for $\frac{n}{12}$ or $n \div 12$ or $\frac{n}{3+4+5}$ or $n \div (3+4+5)$ where $n$ is an integer $\leq 12$
(b)	$1 - \frac{5}{12}$	$\frac{7}{12}$	1	A1 $\frac{5}{12}$ or 0.41(6...) or 41.6% B1 ft 1- $\frac{5}{12}$ provided the answer is positive, or $\frac{7}{12}$ or 0.58(3...)
2	$\frac{22.4 \times 14.5 = 324.8}{8.5 \times 3.2 \quad 27.2}$	11.94117647	2	M1 for 324.8 or 27.2 or $\frac{1624}{5}$ or $\frac{136}{5}$ A1 11.941(17647...) Accept $\frac{203}{17}$ , $11\frac{16}{17}$
3 (a)	Points plotted		1	B1 points plotted $\pm 1$ full smallest square tolerance.
(b)		Negative	1	B1
(c)		lobf	1	B1 lobf that goes between (8,2000) and (8,2400) and between (24,0) and (24,500)
(d)		11-13	1	B1 11-13 or ft (tol $\pm 1$ square) from single straight line segment with a negative gradient
(e)		850-1150	1	B1 850-1150 or ft (tol $\pm 1$ square) ) from single straight line segment with a negative gradient

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4		58° Reason	2	B1 cao B1 (dep) alternate or Z angle (oe)
5		Sketch	2	B2 complete 3-D sketch (B1 for partial 3-D sketch e.g. pyramid only) (B1 for partial 3-D sketch e.g. pyramid or base only, or a shape with a box and 2 pyramids either end) Accept hidden lines as dashed or solid NB: If more than one shape is shown: For 2 marks there should be no choices or alternatives other than those also worth 2 marks; if there are several diagrams of which at least one is worth 1 or 2 marks, award B1. 2D diagrams get B0.

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Question	Working	Answer	Mark	Notes
6		$3n+2$	2	B2 for $3n+2$ (oe, including unsimplified) (B1 for $3n+k$ , $k \neq 2$ )
7	$2 \rightarrow 12$ $3 \rightarrow 33$ $2.5 \rightarrow 20.(625)$ $2.1 \rightarrow 13.(461)$ $2.6 \rightarrow 22.(776)$ $2.2 \rightarrow 15.(048)$ $2.7 \rightarrow 25.(083)$ $2.3 \rightarrow 16.(767)$ $2.8 \rightarrow 27.(5(52)$ $2.4 \rightarrow 18.(624)$ $2.9 \rightarrow 30.(189)$ $2.73 \rightarrow 25.8(06)$ <b><math>2.74 \rightarrow 26.0(508)</math> or <math>26 \leftarrow</math></b> $2.75 \rightarrow 26.2(96)$ $2.76 \rightarrow 26.5(45)$	2.7	4	B2 for trial between 2.7 and 2.8 inclusive (B1 for trial between 2 and 3 inclusive) B1 for different trial between 2.73 and 2.75 inclusive B1 (dep on at least one previous B1) for 2.7 only NB trials where $x$ has 1 d.p should be rounded or truncated to at least 2SF; trials where $x$ has 2 d.p. or more should be rounded or truncated to at least 3SF
8	Points at (5, 4), (15.5, 13), (25.5, 17), (35.5, 19), (45.5, 7)	Polygon	2	B2 Complete polygon (ignore histograms and any lines below a mark of 5 or above a mark of 45, but award B1 if there is a line joining the first to last point) (B1 One vertical or horizontal plotting error OR incorrect but consistent error in placing the midpoints horizontally OR correct plotting but not joined. In this case ignore a line joining first to last) Plotting tolerance $\pm$ half square Points to be joined by lines (ruled or hand-drawn, but not curves)

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9 (a)	$2x+2x+x+10+50=360$	$5x+60=360$	2	M1 3 or 4 out of $2x$ , $2x$ , $x+10$ , $50$ added together
(b)	$5x+60=360$ $5x=300$	60	3	A1 $2x+2x+x+10+50=360$ oe including $x=60$ M1 for isolating their terms in $x$ M1 for dividing their numerical term by the coefficient of their $x$ term A1 cao All the marks in (b) may be given for work done in answering (a) providing there is no contradiction Candidates can score full marks in (b) independent of their answer in (a) (e. g. by starting again)

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Question	Working	Answer	Mark	Notes
10 (a)	$45 \times 2 \div 9$	10	2	M1 for $45 \div "2 + 7"$ or $45 \times 2$ or 5 seen, or 90 seen or 10 seen as part of a ratio e.g 10:35 A1 cao
(b)	$(80 \times 17.5/100) + 80 = 14 + 80 =$	£94	3	M2 for $80 \times \frac{17.5}{100}$ or $80 \times 1.175$ oe A1 cao or M1 for $80 \times 0.175$ or $80 \times \frac{17.5}{100}$ oe or 14 seen or $8 + 4 + 2$ seen M1(dep) '14' + 80 or $80 + 80 \times \frac{17.5}{100}$ oe
(c)	$12000 \times 0.8^2$  <b>OR</b>  1 <sup>st</sup> yr: $12000 \times 0.2 = 2400$ ; $12000 - 2400 = 9600$ 2 <sup>nd</sup> yr: $9600 \times 0.2 = 1920$ ; $9600 - 1920 = 7680$ [3 <sup>rd</sup> year is £6144; 4 <sup>th</sup> yr is £4915.20]	£7680	3	A1 cao M2 for $12000 \times 0.8^2$ or $12000 \times 0.8^3$ A1 cao  <b>OR</b> M1 $12000 \times 0.8$ oe or 9600 or 2400 or 4800 or 7200 seen M1(dep) '9600' $\times 0.8$ oe A1 cao (if correct answer seen, ignore extra years)

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11 (a)		$2a+4c$	1	B1 $2a+4c$ or $2(a+2c)$
(b)	$\frac{1}{2} \times \frac{1}{4} \times (3)^2 = \frac{1}{2} \times \frac{1}{4} \times 9 = 1.125$	1.125	2	M1 for substitution: $\frac{1}{2} \times \frac{1}{4} \times 3^2$ oe A1 1.125, $1\frac{1}{8}$ , $\frac{9}{8}$ oe
(c)		$x(x-5)$	2	B2 , accept $x(x+ -5)$ (B1 for $x$ (linear expression in $x$ ) or $x-5$ seen)
(d)	$x^2 + 3x + 4x + 12$	$x^2+7x+12$	2	B2 for fully correct (B1 for 3 out of 4 terms correct in working including signs, OR 4 terms correct, with incorrect signs).
(e)		$(y+3)(y+5)$	2	B2 for fully correct (B1 for $(y+a)(y+b)$ with one of $ab = 15$ , $a+b = 8$ )

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12 (a)	$\frac{91-85}{85} \times 100 = \frac{6}{85} \times 100 = 7.05882\dots$	7.06%	3	<p>M2 <math>\frac{91-85}{85} \times 100</math></p> <p>(M1 <math>\frac{91-85}{85}</math> or sight of <math>\frac{6}{85}</math> or 0.0705 – 0.071 or <math>\frac{91}{85}</math> or 1.0705 – 1.071)</p> <p>A1 7.05 – 7.06</p> <p>Or</p> <p>M1 <math>\frac{91}{85} \times 100</math> (=107.05)</p> <p>M1 (dep) “107.05” -100</p> <p>A1 7.05-7.06</p> <p>T&amp;I methods must lead to an answer 7.05 – 7.06 for full marks, otherwise 0 marks</p>
(b)	$(64+73+85)/3 = 222/3 = 74$ $(73+85+91)/3 = 249/3 = 83$	74, 83	2	<p>M1 for <math>(64+73+85)/3</math> or <math>(73+85+91)/3</math> or <math>222/3</math> or <math>249/3</math> or 74 or 83 (condone missing brackets)</p> <p>A1 both answers in the correct order cao</p>

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13 (a)	$\pi \times 4^2 \times 10 = 502.65$ (502-503)	503	2	M1 $\pi \times 4^2 \times 10$ (=502.65) A1 502-503
(b)	"502.65" $\times 0.6 = 301.59$	302	2	SC B1 $\pi \times 8^2 \times 10$ M1 "502.65" $\times 0.6$ A1 300 – 302 ft on "502.65" to an answer which would be correct on ft if rounded or truncated to 3SF
14 (a)	$\frac{1}{2} \times 7 \times 8 = \frac{1}{2} \times 56 = 28$	28	2	M1 $\frac{1}{2} \times 7 \times 8$ or $\frac{1}{2} \times 7 \times 8 \times \sin 90^\circ$
(b)	$8^2 + 7^2$ $64 + 49 = 113$ $\sqrt{113} = 10.630145$	10.63	3	A1 cao M1 $8^2 + 7^2$ or 64+49 or 113 or $8^2 + 7^2 - 2 \times 7 \times 8 \times \cos 90$ M1 $\sqrt{\text{"(64+49)"}}$ or $\sqrt{\text{"113"}}$ where it is clear that the 8 and 7 have been squared A1 Any answer in 10.63 – 10.631 inclusive SC B1 10.6 with no working with or without a scale drawing



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(c)	$\tan y = 32/46 = 0.6956$ $\tan^{-1} 0.6956 = 34.82^\circ$	34.8	3	<p>M1 <math>\tan (y =) \frac{32}{46}</math></p> <p>M1 <math>\tan^{-1} 0.695(6)</math> or <math>\tan^{-1} \left( \frac{32}{46} \right)</math> or <math>\tan^{-1} \frac{32}{46}</math> oe            (e.g. 'shift tan' or 'inv tan' for <math>\tan^{-1}</math>)            A1 <math>34.79^\circ - 34.85^\circ</math></p> <p><b>Or</b></p> <p>M1 for <math>\sqrt{(32^2 + 46^2)} (=56.03(5..))</math> and either  <math>\frac{\sin 90}{56.(0..)} = \frac{\sin y}{32}</math> or <math>\frac{56.(0..)}{\sin 90} = \frac{32}{\sin y}</math></p> <p>M1  <math>(y =) \sin^{-1} \left( \frac{32 \times \sin 90}{56.(0..)} \right) (= \sin^{-1}(0.571(06..))</math></p> <p>A1 <math>34.79^\circ - 34.85^\circ</math>            SC1 B2 Radians 0.607-0.608            B2 Gradians 38.65 – 38.7            (both using tan)</p> <p>Alternative methods using Pythagoras and then sin or cos must have a fully correct method for Pythagoras and sin/cos before they score the first M1. The trigonometry could be SOHCAHTOA or Sine rule/Cosine rule</p>

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15	<p><b>B</b> at <math>(-2, -1), (-4, -1)</math> <math>(-2, -4)</math></p> <p><b>C</b> at <math>(4, -1), (6, -1), (4, -4)</math></p>	<p>Rotation <math>180^\circ</math> about <math>(1,0)</math></p>	3	<p>B1 for rotation B1 for <math>180^\circ</math> B1 for centre <math>(1,0)</math></p> <p>OR</p> <p>B1 Enlargement B1 Scale Factor <math>-1</math> Accept <math>-1</math> on its own if it is clear candidate is describing an enlargement B1 Centre <math>(1,0)</math></p> <p>Ignore diagram unless no marks scored, in which case SC B1 for showing both <b>B and C</b> correctly</p> <p>NB Award no marks for the description if more than one transformation is given</p>

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16 (a)	2)252 2)126 3) 63 or factor trees 3) 21 7) 7 1	$2 \times 2 \times 3 \times 3 \times 7$	3	M1 for attempt at continual prime factorisation (at least 2 correct steps); could be shown as a factor tree OR sight of at least one each of 2, 3, 7 as factors of 252 A1 for a fully correct factor tree or 2, 2, 3, 3, 7 which may include 1, but no other numbers A1 $2^2 \times 3 \times 3 \times 7$ or $2^2 \times 3^2 \times 7$ oe
(b)	HCF: The numbers must be $3n$ and $3m$ where $n$ and $m$ are coprime and at most one is a multiple of 3 LCM: Factors of 45 are 1, 3, 5, 9, 15, 45	9 and 15 or 3, 45	3	B3 cao (B2 for 2 numbers with HCF of 9 or LCM of 15) (B1 for any attempt to list any 4 factors of 45 or any 4 multiples of 3).
17	$20 \times 1.51 \times 10^{26}$	$3.02 \times 10^{27}$	2	M1 $20 \times 1.51 \times 10^{26}$ or $3.02 \times 10^n$ or $30.2 \times 10^{26}$ where $n$ is a positive integer A1 cao

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18		Region indicated	3	M1 Both $x=2$ drawn from at least (2,1) to (2,4) and $y=1$ drawn from at least (2,1) to (5,1) M1 for $x+y=6$ drawn from at least (2,4) to (5,1) A1 Correct region indicated by shading or clearly labelled. Boundaries of the region may be solid or dashed.
19	$\frac{150}{360} \times \pi \times 13^2 = 0.416 \times 530.9291585$ $= 221.22\dots$	221	2	M1 for $\frac{150}{360} \times \pi \times 13^2$ or $\pi \times 13^2 \div 2.4$ oe A1 220 - 222
20	(a) $q = \frac{k}{t^2}$ ; $8.5 = \frac{k}{4^2}$ $k = 8.5 \times 4^2$ ; $k = 136$	$q = \frac{136}{t^2}$	3	M1 $q = \frac{k}{t^2}$ , ( $k \neq 1$ ) M1 $8.5 = \frac{k}{4^2}$ A1 cao NB $q = \frac{k}{t^2}$ in the answer line followed by $k$ being found correctly anywhere in (a) or (b) earns all 3 marks
	(b) $q = "136" \div 5^2 = "136" \div 25$	5.44	1	B1 ft for $\frac{136}{25}$ oe

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21 (a)	<p>Freq = FD <math>\times</math> int width = <math>0.018 \times 1000 = 18</math>  Or = <math>18 \times 1 = 18</math></p> <p>= <math>0.010 \times 2000 = 20</math> or <math>10 \times 2 = 20</math></p> <p>= <math>0.006 \times 2000 = 12</math> or <math>6 \times 2 = 12</math></p> <p>OR</p> <p>No of small squares = 200    Total freq = 16</p> <p>So 1 small square = <math>16 \div 200 = 0.08</math>  <math>9 \times 25 \times 0.08 = 18</math>  <math>10 \times 25 \times 0.08 = 20</math>  <math>6 \times 25 \times 0.08 = 12</math></p>	18,20,12	2	M1 use of Freq = FD $\times$ int width or attempt to find freq of 1 standard square (or one answer correct) A1 cao: all three
(b)	<p>OR <math>8 \text{ cm}^2 = 16</math> so <math>1 \text{ cm}^2 = 2</math> etc</p> <p>FD = Freq <math>\div</math> int width = <math>16 \div 2000 = 0.008</math> so  4 sqs up</p> <p>= <math>8 \div 4000 = 0.002</math> so 1 sq up</p> <p>OR</p> <p><math>16 \div 0.08 = 200</math>    <math>200 \div 25 = 8</math> so 4 sqs up  <math>8 \div 0.08 = 100</math>    <math>100 \div 25 = 4</math> so 1 square up</p> <p>OR <math>16 \div 2 = 8</math> so 4 sqs up etc</p>	<p>4000-6000  4 cm high</p> <p>8000-12000  1 cm high</p>	2	B1 4000-6000; 4 cm high B1 8000-12000; 1 cm high or if B0, M1 use of Freq = FD $\times$ int width or attempt to find freq of 1 standard square

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22	<p>238 has an UB 238.5, a LB of 237.5  27.3 has an UB of 27.35, a LB of 27.25</p> <p>Upper: <math>\frac{238.5}{27.25} = 8.75229</math></p>	8.75	3	<p>B1 for one of 238.5, 237.5, 27.35, 27.25, 238.4<math>\dot{9}</math>, 27.34<math>\dot{9}</math> seen</p> <p>M1 for 'UB no of miles'÷'LB no of litres'  Where 238&lt; 'UB no of miles'≤238.5 and 27.25 ≤'LB no of litres'&lt;27.3  A1 8.75 or 8.752 or 8.7522 or 8.7523 or better</p> <p>SC 238.4 ÷ 27.25 which leads to 8.748...B1  M1 A0</p>

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23 (a)	$5(x-1)=(4-3x)(x+2)$ $5x-5=4x+8-3x^2-6x (=8-2x-3x^2)$ $(3x^2+6x+5x-4x-5-8=0)$ $3x^2+7x-13=0$	Proof	3	M1 multiply through by $(x-1)(x+2)$ and cancel correctly M1 expand $5(x-1)$ and $(4-3x)(x+2)$ correctly, need not be simplified A1 rearrange to give required equation (dep on both Ms and fully correct algebra)
(b)	$a=3, b=7, c=-13$ $x=\frac{-7\pm\sqrt{(7^2+4\times3\times13)}}{6}=\frac{-7\pm\sqrt{(49+156)}}{6}=\frac{-7\pm\sqrt{205}}{6}$ $x=1.2196\dots \text{ or } -3.55297\dots$ <p>Or</p> $\left(x+\frac{7}{6}\right)^2-\left(\frac{7}{6}\right)^2-\frac{13}{3}=0$ $\left(x+\frac{7}{6}\right)=\pm\sqrt{\left(\frac{7}{6}\right)^2+\frac{13}{3}}$ $x=1.2196\dots \text{ or } -3.55297\dots$	1.22 -3.55	3	M1 correct substitution in formula of $a=3, b=7$ and $c=\pm13$ M1 reduction to $\frac{-7\pm\sqrt{205}}{6}$ A1 1.215 to 1.22 and $-3.55$ to $-3.555$ Or M1 $\left(x+\frac{7}{6}\right)^2$ M1 $-\frac{7}{6}\pm\sqrt{\frac{205}{36}}$ A1 1.215 to 1.22 and $-3.55$ to $-3.555$ SC T&I 1 mark for 1 correct root, 3 marks for both correct roots

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24	$\cos x = \frac{12^2 + 10^2 - 15^2}{2 \times 12 \times 10} = \frac{19}{240}$ $x = \cos^{-1} 0.079 = 85.459\dots$ <p>OR</p> $15^2 = 12^2 + 10^2 - 2 \times 12 \times 10 \times \cos x$ $\cos x = \frac{15^2 - 12^2 - 10^2}{-2 \times 12 \times 10} = \frac{12^2 + 10^2 - 15^2}{2 \times 12 \times 10} = \frac{19}{240}$ $x = \cos^{-1} 0.079 = 85.459\dots$	85.5	3	<p>M2 <math>\cos A = \frac{12^2 + 10^2 - 15^2}{2 \times 12 \times 10}</math></p> <p>A1 85.4 -85.5</p> <p>OR</p> <p>M1 correct substitution into <math>a^2 = b^2 + c^2 - 2bc \cos A</math></p> <p>M1 correct rearrangement of <math>a^2 = b^2 + c^2 - 2bc \cos A</math> algebraically to</p> $(\cos A) = \frac{b^2 + c^2 - a^2}{2 \times b \times c} \text{ oe}$ <p>or to</p> $(\cos A =) \frac{12^2 + 10^2 - 15^2}{2 \times 12 \times 10} \text{ oe}$ <p>These can be earned in either order</p> <p>A1 85.4-85.5</p> <p>SC B2 Radians 1.49 seen</p> <p>B2 Gradians 94.89-95 seen</p>



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25	$7 = ka^1 ; 175 = ka^3$ $k = \frac{7}{a}, 175 = \frac{7a^3}{a}, 175 = 7a^2$ $a^2 = 25, \text{ so } a = 5, k = 1.4$ Or $7^3 = k^3 a^3, 175 = ka^3$ $k^2 = \frac{7^3}{175}, k = 1.4, a = 5$	$k = 1.4$ $a = 5$	3	M1 either $a^2 = 25$ or $7 = ka$ (or $7 = ka^1$ ) and $175 = ka^3$ A1 $k = 1.4$ oe A1 $a = 5$  SC Either $a = 5$ or $k = 1.4$ oe gets B2