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Mark scheme

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Key to mark types and abbreviations

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
[a, b)	Accept values $a \leq \text{value} < b$
3.14 ...	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Q	Answer	Mark	Comments
1(a)	$a \times b \times c$	B1	

Q	Answer	Mark	Comments
1(b)	$w = y + 4$	B1	

Q	Answer	Mark	Comments
2(a)	cuboid	B1	

Q	Answer	Mark	Comments
2(b)	decagon	B1	

Q	Answer	Mark	Comments
3	radius tangent circumference	B3	B1 for each
	Additional Guidance		
	Allow any unambiguous indication eg rad for radius		
	Allow half the diameter for radius		
	Allow $\pi \times \text{diameter}$ or $2\pi \times \text{radius}$ for circumference		

Q	Answer	Mark	Comments
4	Alternative method 1		
	$60 \div 5$ or 12	M1	oe
	their 12×8 or $60 + 3 \times$ their 12 or $60 + 36$	M1dep	oe build up/build down to 8 packs eg $2 \times 60 - 2 \times$ their 12 or $120 - 24$
	96	A1	
	Alternative method 2		
	$60 \times 8 (\div 5)$ or $480 (\div 5)$	M1	oe
	$60 \times 8 \div 5$ or their $480 \div 5$	M1dep	oe
	96	A1	
	Alternative method 3		
	$\frac{8}{5}$ or $\frac{8-5}{5}$ or $\frac{3}{5}$	M1	oe
	$\frac{8}{5} \times 60$ or $60 + \frac{3}{5} \times 60$	M1dep	oe
	96	A1	
	Additional Guidance		
	$60 \times 8 \times 5$		M0

Q	Answer	Mark	Comments	
5	9 + 20 = 29 or 20 + 9 = 29	B2	B1 a correct calculation with a square number and a multiple of 10 in the left-hand boxes or a correct calculation with a square number in a left-hand box and 23 or 29 in the right-hand box or a correct calculation with a multiple of 10 in a left-hand box and 23 or 29 in the right-hand box or a list of 3 consecutive square numbers or a list of 2 consecutive multiples of 10 or 23 and 29 with no incorrect prime numbers	
	Additional Guidance			
	Allow square numbers to be written in index form, eg 3 ² + 20 = 29		B2	
	Allow the multiple of 10 to be written as a multiplication eg 9 + 2 × 10 = 29		B2	
	Some examples of B1 with correct calculations 4 + 10 = 14 square number + multiple of 10 4 + 25 = 29 square number and 29 in right-hand box −17 + 40 = 23 multiple of 10 and 23 in right-hand box 30 + −1 = 29 multiple of 10 and 29 in right-hand box		B1	
	10 + 25 = 29 multiple of 10 + square number but incorrect calculation		B0	

Q	Answer	Mark	Comments
6(a)	BW YB YW WB WY	B2	B1 two or three correct with 0 incorrect or four correct with 0 or 1 incorrect or five correct with 1 or 2 incorrect
	Additional Guidance		
	Any unambiguous indication		
	Repeating the given BY is B1 max unless the given letters are crossed out		
	Ignore repeats for B1 only		
	Ignore BB, YY, WW for B1 only		

Q	Answer	Mark	Comments
6(b)	$\frac{4}{6}$ or $\frac{2}{3}$	B1ft	oe fraction correct or ft their list
	Additional Guidance		
	If BY was repeated in (a) allow correct probability (ignoring the repeat) or follow through their new total		
	Ignore incorrect simplification once correct fraction seen		

Q	Answer	Mark	Comments
7	Fully correct diagram with all heights correct and 1 cm gaps between days	B2	B1 at least 4 of the 6 bar heights correct
	Additional Guidance		
	Mark intention		
	Ignore gaps or no gaps and incorrect widths for B1		
	If no shading assume bar on the left is Town A		

Q	Answer	Mark	Comments
8	28×16 or 448 or 32×24 or 768	M1	oe implied by 582 or 902 or 1216
	1350 – their 448 – their 768 or 1350 – 1216	M1dep	oe must subtract two whole number amounts with at least one from a correct method
	134	A1	
	Additional Guidance		
	$28 \times 16 = 448$ $1350 - 448 = 56$ 846		M1 M1 A0

Q	Answer	Mark	Comments
9(a)	18	B1	may be on diagram

Q	Answer	Mark	Comments
9(b)	$27 \div 3 + 2$ or $9 + 2$ or $(11 - 2) \times 3$ or $x - 2 = 27 \div 3$ or $x - 2 = 9$	M1	oe
	11	A1	SC1 83 or 7 or $\frac{29}{3}$ oe
	Additional Guidance		
	If answer line blank and answer not in working space, check the input box on the diagram		
	Embedded answer		M1A0

Q	Answer	Mark	Comments
9(c)	$3(x - 2)$	B1	

Q	Answer	Mark	Comments
10	Alternative method 1		
	$100 - 28 - 16$ or 56 or $1 - 0.28 - 0.16$ or 0.56	M1	oe
	$\frac{\text{their } 56}{100} \times 125$ or $\text{their } 0.56 \times 125$	M1dep	oe
	70	A1	
	Alternative method 2		
	$\frac{28}{100} \times 125$ or 35 or $\frac{16}{100} \times 125$ or 20 or $\left(\frac{28}{100} + \frac{16}{100} \right) \times 125$ or 55	M1	oe
	$125 - \frac{28}{100} \times 125 - \frac{16}{100} \times 125$ or $125 - \text{their } 35 - \text{their } 20$ or $125 - \text{their } 55$	M1dep	oe their 35 and their 20 must be from correct methods
	70	A1	
	Additional Guidance		
	Up to M2 may be awarded for correct work with no or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
11(a)	$10 \times -4 - 3 \times 2$ or $(10a =) -40$ or $(3b =) 6$	M1	
	-46	A1	
	Additional Guidance		
	40 – 6		M1
	40 + 6		M0

Q	Answer	Mark	Comments
11(b)	$2 = 10a - 3 \times 1$ or $2 + 3 = 10a$	M1	oe
	$\frac{5}{10}$ or $\frac{1}{2}$ or 0.5	A1	oe
	Additional Guidance		
	Embedded answer		M1A0

Q	Answer	Mark	Comments
12(a)	Alternative method 1		
	3.6 and 3.8 and 3.8 and 4.1 and 4.6	M1	allow one omission or incorrect mass may be implied by 19.9
	$(3.6 + 3.8 + 3.8 + 4.1 + 4.6) \times 11.3(0)$ or $19.9 \times 11.3(0)$	M1dep	allow one omission or incorrect mass
	224.87	A1	SC2 2248.7(0) SC1 98.31 or 190.97
	Alternative method 2		
	3.6 $\times$ 11.3(0) or 40.68 or 3.8 $\times$ 11.3(0) or 42.94 or 2 $\times$ 3.8 $\times$ 11.3(0) or 85.88 or 4.1 $\times$ 11.3(0) or 46.33 or 4.6 $\times$ 11.3(0) or 51.98	M1	oe cost of one of the five heaviest lobsters may be contained within a longer calculation
	$3.6 \times 11.3(0) + 3.8 \times 11.3(0) + 3.8 \times 11.3(0) + 4.1 \times 11.3(0) + 4.6 \times 11.3(0)$	M1dep	oe allow one error or omission
	224.87	A1	SC2 2248.7(0) SC1 98.31 or 190.97
	Additional Guidance		
	$4.6 \times 11.3(0) \times 5$ oe	M1	
	$1.8 \times 11.3(0) + 2.9 \times 11.3(0) + 2 \times 3.8 \times 11.3(0) + 4.6 \times 11.3(0)$	M1	
	$1.8 + 2.9 + 2 \times 3.8 + 4.6 = 16.9$ and $16.9 \times 11.3(0)$ implies M1 (alt 2)	M1	
	$11.3(0) \times 5$	M0	

Q	Answer	Mark	Comments
12(b)	$\frac{10+1}{2}$ or 5.5 or 2.1 and 2.3 indicated	M1	may indicate 2.1 and 2.3 on diagram
	2.2	A1	SC1 2.65 or 3.7 or 22
	Additional Guidance		
	Median of non-standard = 3.7		SC1
	Median of all = 2.65		SC1

Q	Answer	Mark	Comments
13	Alternative method 1		
	20:26 – 18:50 or 1 h 36 m or 96 or 1.6	M1	
	$7.2 \div 4.8$ or 1.5 or 1 h 30 m or 90	M1	
	Running and 1 h 36 m and 1 h 30 m or Running and 96 and 90 or Running and 1.6 and 1.5	A1	condone Running and 1 h 36 m and 1.5 or Running and 1.6 and 1 h 30 m
	Alternative method 2		
	$7.2 \div 4.8$ or 1.5 or 1 h 30 m or 90	M1	
	18:50 + their 1 h 30 m or 18:50 + their 90 or 20:20	M1dep	
	Running and 20:20	A1	
	Additional Guidance		
	Condone 1.36 and 1.3(0) for M marks only		
	1 h 50 does not imply 1.5		

Q	Answer	Mark	Comments
14	$7 \times 19 \times 2$ or 7×19 or 133 or 399 or 665 or 931	M1	oe
	266 or 532 or 798	A1	
	Additional Guidance		
	If values seen in lists of multiples, the value must be selected		
	$266 \div 7 = 38$ $38 \div 19 = 2$ and answer 2 or answer line blank		M1A0

Q	Answer	Mark	Comments
15	Alternative method 1		
	$144 \div 5$ or 28.8	M1	oe
	$2x + \text{their } 28.8 = 77.8$ or $77.8 - \text{their } 28.8$ or 49 or a correct trigonometric equation or calculation leading to x	M1dep	oe eg $y + \text{their } 28.8 = 77.8$ (any letter other than x) eg $\cos 54 = \frac{\text{their } 28.8 \div 2}{x}$ or $\frac{\text{their } 28.8 \div 2}{\cos 54}$
	24.5	A1	oe
	Alternative method 2		
	$77.8 \times 5 - 10x$ or $5x + 144$ and $5 \times (77.8 - x)$	M1	oe expressions for perimeter of pentagon or perimeter of pentagon and internal lines in terms of x
	$77.8 \times 5 - 10x = 144$ or $5x + 144 = 5 \times (77.8 - x)$	M1dep	oe
	24.5	A1	oe
	Additional Guidance		
	Up to M2 may be awarded for correct work with no or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
16(a)		B1	

Q	Answer	Mark	Comments
16(b)	28	B1	
	cm ² or square centimetres	B1	
	Additional Guidance		
	cm ² may be seen in working or on answer line		

Q	Answer	Mark	Comments
17(a)	0.31	B1	

Q	Answer	Mark	Comments
17(b)	0.23 + 0.34 or 1 – (0.12 + 0.31) or 0.57 or 0.23 × 300 or 69 or 0.34 × 300 or 102 or 0.12 × 300 or 36 or 0.31 × 300 or 93	M1	oe may be contained within a calculation
	171	A1	
	Additional Guidance		
	0.31 + 0.34 = 0.65 and 0.65 × 300 implies 0.34 × 300		M1

Q	Answer	Mark	Comments
18	3 correct lines	B3	B2 2 correct lines B1 1 correct line
	Additional Guidance		
	$4 < x \leq 9$ $4 \leq x < 9$ $4 \leq x \leq 9$		4, 5, 6, 7, 8, 9 5, 6, 7, 8, 9 4, 5, 6, 7, 8 5, 6, 7, 8 B3
	Additional Guidance		
	2 lines from one original inequality is choice		

Q	Answer	Mark	Comments	
19	B and 50^{70} and 50^{72} or B and $[8, 8.5] \times 10^{118}$ and $[2, 2.12] \times 10^{122}$ or B and $\frac{A}{B} = 50^{-2}$ oe or B and $\frac{B}{A} = 50^2$ oe	B2	B1 50^{70} or 50^{72} or $[8, 8.5] \times 10^{118}$ or $[2, 2.12] \times 10^{122}$ or $\frac{A}{B} = 50^{-2}$ oe or $\frac{B}{A} = 50^2$ oe or 50^{30+40} and 50^{75-3}	
	Additional Guidance			
	Accept answer of 50^{72} with 50^{70} seen		B2	
	Accept answer of $50^{75} \div 50^3$ with 50^{70} and 50^{72} seen		B2	
	Accept B and 70 and 72		B2	
	Answer only 50^{72}		B1	
	Answer only B or $50^{75} \div 50^3$		B0	

Q	Answer	Mark	Comments
20(a)	40	B1	

Q	Answer	Mark	Comments
20(b)	$28.8 \div 9$ or 3.2 or $9 \div 28.8$ or 0.3125 or $\frac{7}{9}$ or $\frac{9}{7}$	M1	oe may be seen on diagram
	22.4	A1	oe

Q	Answer	Mark	Comments
21(a)	A correct statement relating to the difference between the two distributions	B1	
	Additional Guidance		
	A correct statement may refer to different measures of location, eg different modal classes or the different shapes of the distributions or a correct interpretation of one of the distributions		
	Condone 'mode' or 'peak' for modal class		
	Any reading(s) from the graph(s) must be correct		
	Comments may compare parts of the distributions but not particular points other than the class midpoints		
	Parts of the distributions may be referred to using class intervals or midpoints eg 0 to 5 or 2.5, 10 to 15 or 12.5		
	Ignore irrelevant, non-contradictory statements		
	More part-time people travel less	B1	
	More full-time workers live further away	B1	
	There are more part-time workers travelling a short distance	B1	
	(On average) full-time workers travel further	B1	
	The modal class of the full-time workers is in the middle	B1	
	The full-time workers graph is (almost) symmetrical	B1	
	The part-time workers graph decreases	B1	
	The part-time graph goes down at the beginning, full-time graph goes up	B1	
	The part-time workers graph decreases, full-time workers graph increases	B1	
	The full-time workers peak at 12.5 but the part-time workers do not	B1	
	36 full-time workers travel 12.5 km, 6 part-time travel 12.5 km	B1	
	25 full-time workers travel 10 km, 13 part-time travel 10 km	B0	
	The part-time graph is negative	B0	
	The part-time workers are inversely proportional to the distance	B0	
	There are more full-time workers	B0	

Q	Answer	Mark	Comments												
21(b)	Correct class boundaries	B1													
	Correct frequencies	B2	B1 2 or 3 frequencies correct or frequencies of (24), 21, 6, 2, 2 for the part-time workers seen or frequencies of (8), 14, 36, 17, 10 for the full-time workers seen												
	Additional Guidance														
	<table><tr><th>Distance travelled, d (km)</th><th>Frequency (all workers)</th></tr><tr><td>$0 \leq d < 5$</td><td>32</td></tr><tr><td>$5 \leq d < 10$</td><td>35</td></tr><tr><td>$10 \leq d < 15$</td><td>42</td></tr><tr><td>$15 \leq d < 20$</td><td>19</td></tr><tr><td>$20 \leq d < 25$</td><td>12</td></tr></table>		Distance travelled, d (km)	Frequency (all workers)	$0 \leq d < 5$	32	$5 \leq d < 10$	35	$10 \leq d < 15$	42	$15 \leq d < 20$	19	$20 \leq d < 25$	12	B1B2
	Distance travelled, d (km)	Frequency (all workers)													
$0 \leq d < 5$	32														
$5 \leq d < 10$	35														
$10 \leq d < 15$	42														
$15 \leq d < 20$	19														
$20 \leq d < 25$	12														
Correct frequencies for the part-time or full-time workers may be on the graph															

Q	Answer	Mark	Comments
22	True False True	B2	B1 2 correct
	Additional Guidance		
	Any indication		
	If there are ticks and crosses in the same row, mark the ticks		

Q	Answer	Mark	Comments
23	$\frac{2}{3} \times 72$ or 48 or $\left(1 - \frac{2}{3}\right) \times 72$ or $\frac{1}{3} \times 72$ or 24	M1	oe
	$180 \div (5 + 4)$ or 20	M1	oe
	5 × their 20 or 100 or 4 × their 20 or 80	M1dep	oe dep on 2nd M1 $\frac{5}{5+4} \times 180$ implies 2nd and 3rd M1 $\frac{4}{5+4} \times 180$ implies 2nd and 3rd M1
	$\frac{\text{their 48} + \text{their 100}}{72 + 180}$ or $\frac{\text{their 48} + \text{their 100}}{252}$ or $1 - \frac{\text{their 24} + \text{their 80}}{72 + 180}$ or $1 - \frac{\text{their 24} + \text{their 80}}{252}$	M1	oe denominator must = 72 + 180 or 252 their 48 and their 72 must be integers their 48 must be < 72 their 100 must be < 180 their 24 and their 80 must be integers their 24 must be < 72 their 80 must be < 180 must not mix the number of open and closed shops
	$\frac{148}{252}$ or $\frac{74}{126}$ or $\frac{37}{63}$	A1	oe fraction

Additional Guidance is on the next page

23 cont	Additional Guidance	
	Ignore incorrect cancellation of a fraction if correct answer seen	
	Up to M4 may be awarded for correct work with no or incorrect answer, even if this is seen amongst multiple attempts	
	A correct fraction seen but decimal or percentage on answer line	M1M1M1M1A0
	0.587... or 0.59 or 58.7...% or 59%	M1M1M1M1A0
	$148 \div 252$	M1M1M1M1
	148 (shops open) or 104 (shops closed)	M1M1M1
	37 : 63	M1M1M1
	100 : 80 scores the 2nd and 3rd M marks	M1M1

Q	Answer	Mark	Comments
24	Alternative method 1		
	$\tan 49 = \frac{x}{26}$ or $\frac{x}{26} = 1.15\dots$	M1	any letter oe eg $\tan (90 - 49) = \frac{26}{x}$ or $\tan 41 = \frac{26}{x}$ or $\frac{x}{\sin 49} = \frac{26}{\sin (90 - 49)}$ oe or $\frac{x}{\sin 49} = 39.6\dots$ or $\sin 49 \div x = 0.025\dots$
	$26 \times \tan 49$ or $26 \times 1.15\dots$ or [29.9, 30]	M1dep	oe eg $26 \div \tan 41$ or $26 \times \sin 49 \div \sin 41$
	[31.9, 32]	A1	
	Alternative method 2		
	$x = \frac{26}{\cos 49}$ or 39.63... and $x^2 - 26^2$ or [894.5, 894.6]	M1	oe eg $x = \frac{26}{\sin(90 - 49)}$ and $x^2 - 26^2$ or [894.5, 894.6]
	$\sqrt{\text{their [894.5, 894.6]}}$ or [29.9, 30]	M1dep	
	[31.9, 32]	A1	
	Additional Guidance		
	In the equation for M1, x may appear as $x - 2$ (where x is the height of the tree)		
	$\cos 49 = \frac{26}{x}$ or $\sin 41 = \frac{26}{x}$ with no further relevant working		M0

Q	Answer	Mark	Comments
25	$5a = 20$ or $b + 3 = -11$	M1	oe allow $5ax = 20x$
	$a = 4$ or $b = -14$	A1	
	$a = 4$ and $b = -14$	A1	
	Additional Guidance		
	$5ax = 20$ is M0 unless recovered		

Q	Answer	Mark	Comments
26	-6	B1	

Q	Answer	Mark	Comments
27	Alternative method 1		
	$41 \times 2 + x (= 97)$ or $0.5 \times (97 - x) (= 41)$	M1	oe
	$97 - 41 \times 2$ or 15	M1dep	oe
	$(41 - \text{their } 15) \div 2$ or 13 or a correct use of $-$ their 15, then $\div 2$	M1dep	oe eg $41 \div 2 - 7.5$ correct 2nd term using their 15 or correct 1st term for their 2nd term dep on M1M0
	-1	A1	
	Alternative method 2		
	$97 \div 2$ or 48.5	M1	oe
	their 48.5 $- 41$ or 7.5	M1dep	oe
	$41 \div 2 - \text{their } 7.5$ or 13 or a correct use of $\div 2$, then $-$ their 7.5	M1dep	oe correct 2nd term using their 7.5 or correct 1st term for their 2nd term dep on M1M0
	-1	A1	
	Alternative method 3 Simultaneous equations starting from the 2nd term, b		
	$2b + x (= 41)$ and $4b + 3x (= 97)$	M1	oe equations any letter for b other than x
	Correctly eliminates b to obtain an equation in x or $x = 15$ or correctly eliminates x to obtain an equation in b	M1dep	eg $3x - x \times 2 = 97 - 41 \times 2$ eg $3 \times 2b - 4b = 41 \times 3 - 97$
	$(41 - \text{their } 15) \div 2$ or $(97 - 3 \times \text{their } 15) \div 4$ or $(123 - 97) \div 2$ or 13	M1dep	oe calculation eg $b = (82 - 2 \times \text{their } 15) \div 4$
	-1	A1	

Mark scheme and Additional Guidance continues on the next page

Q	Answer	Mark	Comments
27 cont	Alternative method 4 Simultaneous equations starting from the 1st term, a		
	$4a + 3x (= 41)$ and $8a + 7x (= 97)$	M1	oe equations any letter for a other than x
	Correctly eliminates a to obtain an equation in x or $x = 15$ or correctly eliminates x to obtain an equation in a	M1dep	eg $7x - 3x \times 2 = 97 - 41 \times 2$ eg $7 \times 4a - 3 \times 8a = 41 \times 7 - 3 \times 97$
	$(41 - 3 \times \text{their } 15) \div 4$ or $(97 - 7 \times \text{their } 15) \div 8$ or $(41 \times 7 - 3 \times 97) \div 4$	M1dep	oe calculation
	-1	A1	
	Additional Guidance		
	Up to M3 may be awarded for correct work with no or incorrect answer, even if this is seen amongst multiple attempts		
	If answer line is blank then -1 and/or 13 may be seen on the blanks in the sequence		
	-1 in working but a different answer on answer line eg -8		M1M1M1A0
	$82 + x = 97$ $x = 15$ 2nd term = 33.5 1st term = 9.25 (a correct use of - their 15, then $\div 2$ to get the 1st term for their 2nd term)		M1M1M1A0
	$82 + x = 97$ $x = -15$ 2nd term = 28 (a correct evaluation of $(41 - \text{their } 15) \div 2$ to get the 2nd term)		M1M0M1A0
	Answer 15		M1M1