1. (a) $\Sigma fx = 1(2) + 2(4) + ... + 7(4)$, $\Sigma fx = 146 + 5x$ (seen anywhere) A1

evidence of substituting into mean = $\frac{\sum fx}{\sum f}$ (M1)

correct equation A1

e.g. $\frac{146+5x}{34+x} = 4.5$, $146 + 5x = 4.5(34 + x)$

$x = 14$ A1 N2

(b) $\sigma = 1.54$ A2 N2

[6]

2. (a) (i) evidence of appropriate approach (M1)

e.g. $9 + 25 + 35$, $34 + 35$

$p = 69$ A1 N2

(ii) evidence of valid approach (M1)

e.g. 109 – their value of p, $120 – (9 + 25 + 35 + 11)$

$q = 40$ A1 N2

(b) evidence of appropriate approach (M1)

e.g. substituting into $\frac{\sum fx}{n}$, division by 120

mean = 3.16 A1 N2

(c) 1.09 A1 N1

[7]

3. (a) $\sigma = 1.61$ A2 N2

(b) median = 4.5 A1 N1

(c) $Q_1 = 3$, $Q_3 = 5$ (may be seen in a box plot) (A1)(A1)

IQR = 2 (accept any notation that suggests the interval 3 to 5) A1 N3

[6]

4. (a) evidence of using mid-interval values (5, 15, 25, 35, 50, 67.5, 87.5) (M1)

$\sigma = 19.8$ (cm) A2 N3

(b) (i) $Q_1 = 15$, $Q_3 = 40$ (A1)(A1)

$IQR = 25$ (accept any notation that suggests the interval 15 to 40) A1 N3

(ii) **METHOD 1**

60 % have a length less than k (A1)
$0.6 \times 200 = 120$ (A1)
k 30 (cm) A1 N2

METHOD 2

$0.4 \times 200 = 80$ (A1)
$200 - 80 = 120$ (A1)
$k = 30$ (cm) A1 N2

(c) $l < 20$ cm $\Rightarrow$ 70 fish (M1)

P(small) = $\frac{70}{200}$ (= 0.35) A1 N2

(d)

Cost \$$X$	4	10	12
P($X = x$)	**0.35**	0.565	**0.085**

A1A1 N2

(e) correct substitution (of their p values) into formula for E(X) (A1)
e.g. $4 \times 0.35 + 10 \times 0.565 + 12 \times 0.085$

E(X) = 8.07 (accept \$8.07) A1 N2

[15]

5. (a) (i) $p = 65$ A1 N1

(ii) for evidence of using sum is 125 (or $99 - p$) (M1)
$q = 34$ A1 N2

(b) evidence of median position (M1)

e.g. 63rd student, $\frac{125}{2}$

median is 17 (sit-ups) A1 N2

(c) evidence of substituting into $\frac{\sum f(x)}{125}$ (M1)

e.g. $\frac{15(11)+16(21)+17(33)+18(34)+19(18)+20(8)}{125}, \frac{2176}{125}$

mean = 17.4 A1 N2

[7]

6. (a) A = 18, B = 19, C = 23, D = 31, E = 36 A1A1A1A1A1 N5

(b) IQR = 12 A1 N1

[6]

7. (a) Correct mid interval values 14, 23, 32, 41, 50 (A1)

Substituting into $\frac{\sum f w}{\sum f}$ M1

eg $\bar{w} = \frac{7(14)+12(23)+13(32)+10(41)+8(50)}{50}$

$\bar{w} = \frac{1600}{50}$ A1

$\bar{w}$ = 32 (kg) AG N0

(b) **METHOD 1**

Total weight of other boxes = $1600 - 50x$ (A1)

Total number of other boxes = $50 - x$ (A1)

Setting up **their** equation M1

eg $\frac{1600-50x}{50-x} = 30$, $1600 - 50x = 1500 - 30x$

$x = 5$ A1 N3

METHOD 2

Let z be the number of other boxes in Class E (accept any symbol in the working, even including x).

Total weight of other boxes = $1200 + 50z$ (A1)

Total number of other boxes = $42 + z$ (A1)

Setting up **their** equation M1

eg $\frac{1200-50z}{42+z} = 30$, $1200 + 50z = 1260 + 30z$

$z = 3$

$x = 5$ A1 N3

(c) Setting up their inequality M1

Correct substitution A1

eg $\frac{98+276+416+41(10+y)+400}{50+y} < 33$, $\frac{1600-41y}{50+y} < 33$

$1600 + 41y < 1650 + 33y$ (A1)

$8y < 50$ ($y < 6.25$) A1

6 A1 N1

Note: *If candidates don't use the mid-interval values, but assume that all the new boxes weigh the minimum amount for Class D, award marks as follows:*

Setting up **their** inequality M1

Correct substitution A1

eg $\frac{1600-36.5y}{50+y} < 33$

$1600 + 36.5y < 1650 + 33y$ (A1)

$3.5y < 50$ ($y < 14.28...$) A1

14 A1 N1

[12]

8. (a)

Age range	Frequency	Mid - interval value
$0 \leq \text{age} < 20$	40	10
$20 \leq \text{age} < 40$	**70**	**30**
$40 \leq \text{age} < 60$	**100**	**50**
$60 \leq \text{age} < 80$	**50**	**70**
$80 \leq \text{age} \leq 100$	**10**	**90**

A1A1 N2

(b) For attempting to find $\sum f x$ (M1)

Correct substitution (A1)

eg $40 \times 10 + ... + 10 \times 90 = 11900$

For dividing by 270 (M1)

eg $\frac{11900}{270}$

Mean = 44.1 A1 N4

[6]

9. (a) Mean = $\frac{\sum f x}{\sum f}$

$\sum f x$ = (1) (0) + (2) (4) + (3) (6) + (4) (*k*) + (5) (8) + (6) (6) + (7) (6) (A1)

$\sum f$ $k + 30$ (A1)

Using mean 4.6 = $\frac{144+4k}{k+30}$ (M1)

$4.6k + 138 = 144 + 4k$ (A1)

$0.6k = 6$

$k = 10$ (A1) (C5)

(b) Mode = 4 (A1) (C1)

(accept 5, if k < 8)

[6]

10.

x	f	Σf
4	2	2
5	5	7
6	4	11
7	3	14
8	4	18
10	2	20
12	1	21

(a) m = 6 (A2) (C2)

(b) $Q_1 = 5$ (A2) (C2)

(c) $Q_3 = 8$ (A1)
IQR = 8 – 5 (M1)
= 3 (accept 5 – 8 or [5, 8]) (C2)

[6]

11. (a) Median = middle number of 75 (M1)
= 38th number
= 4 (A1) (C2)

(b) Mean = $\frac{5+18+48+72+100+42}{75}$ (M1)

$= \frac{285}{75}$

= 3.8 (A1) (C2)

[4]

12. (a) (Using mid-intervals)

$\bar{v} = \frac{65(7)+75(25)+...+135(5)}{7+25+...+5}$ (M1)

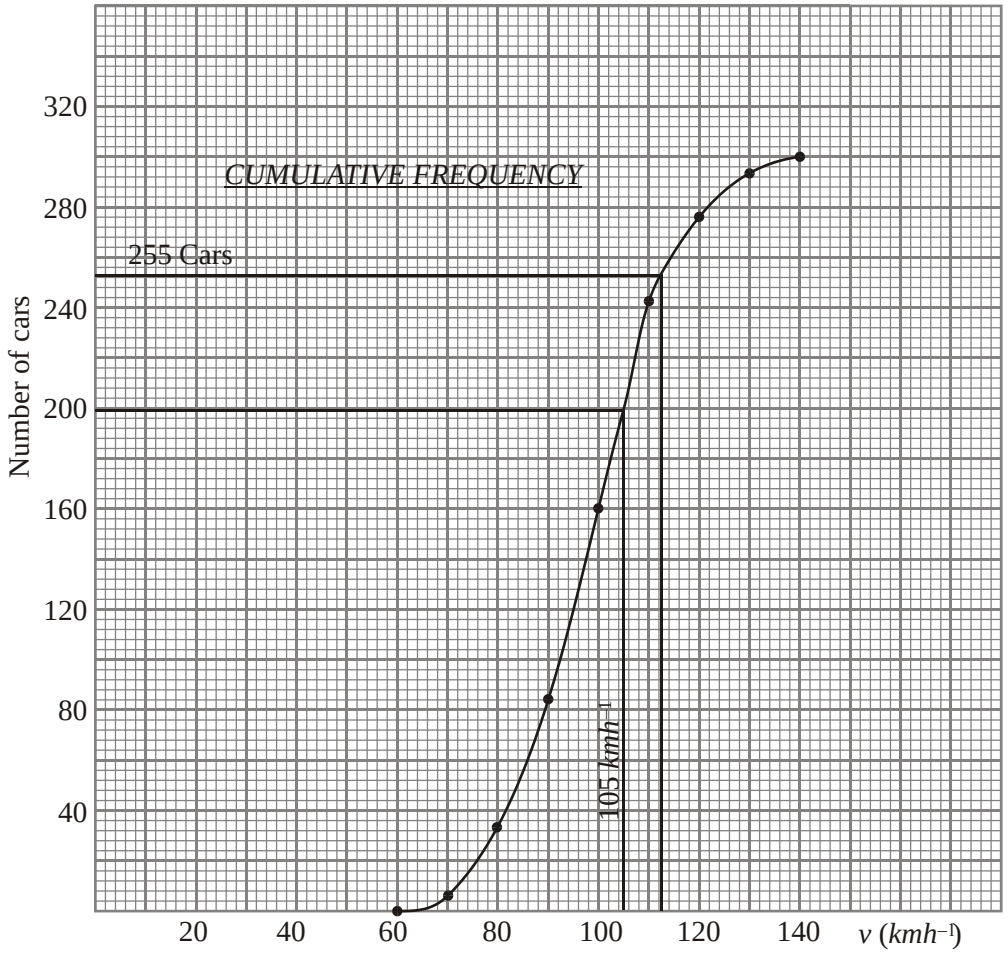
$= \frac{29450}{300}$ = 98.2 km h^{-1} (A1)

OR

$\bar{v}$ = 98.2 (G2) 2

(b) (i) $a = 165$, $b = 275$ (A1)

(ii)



(A4) 5

Note: *Award (A1) for properly marked scales and axes, (A2) for 9 correctly plotted points, (A1) for 7 or 8 points, (A1) for a smooth curve through the points.*

(c) (i) Vertical line on graph at 105 km h^{-1} (M1)

$\frac{300-200}{300} \times 100\% = 33.3(\pm 1.3\%)$ (A1)

OR

$33.3(\pm 1.3\%)$ (A2)

(ii) 15% of 300 = 45 $\quad$ 300 – 45 = 255
Horizontal line on graph at 255 cars (M1)
Speed = 114(± 2 km h^{-1}) (A1)

OR

Speed = 114(± 2 km h^{-1}) (A2) 4

[11]

13. (a) (i) 10 (A1)

(ii) 14 + 10 = 24 (A1) 2

(b)

	x_i	f_i	
(A1)	15	1	(A1)
	25	5	
	35	7	
	45	9	
	55	10	
	65	16	
	75	14	
	85	10	
	95	8	
		80	(AG)

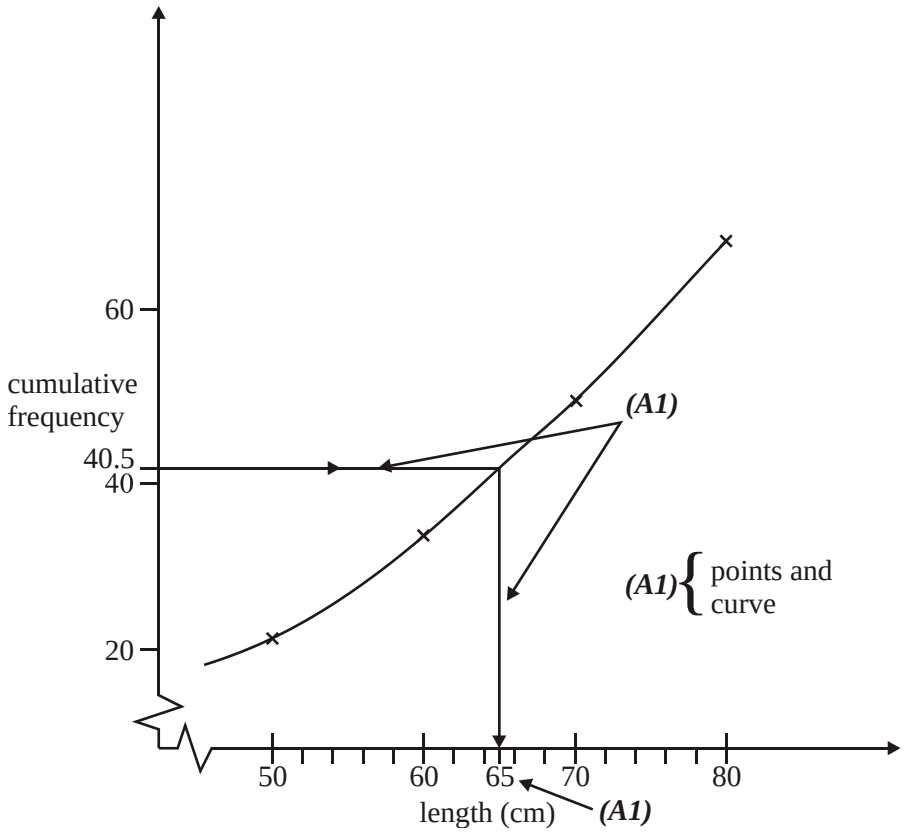
Note: *Award (A0) for using the mid-interval values of 14.5, 24.5 etc.*

(i) μ = 63 (A1)

(ii) σ = 20.5 (3 sf) (A1) 4

(c) Assymetric diagram/distribution (A1) 1

(d)



3

OR Median = 65 (A3) 3

Note: *This answer assumes appropriate use of a calculator with correct arguments.*

OR Linear interpolation on the table: (M1)

$\left(\frac{48-40.5}{48-32}\right)\times 60+\left(\frac{40.5-32}{48-32}\right)\times 70 = 65$ (2sf) (A1)(A1) 3

[10]

14. (a) $\bar{x}$ = \$59 (G2)

OR

$\bar{x}=\frac{10\times 24+30\times 16+...+110\times 10+130\times 4}{24+16+...+10+4}$ (M1)

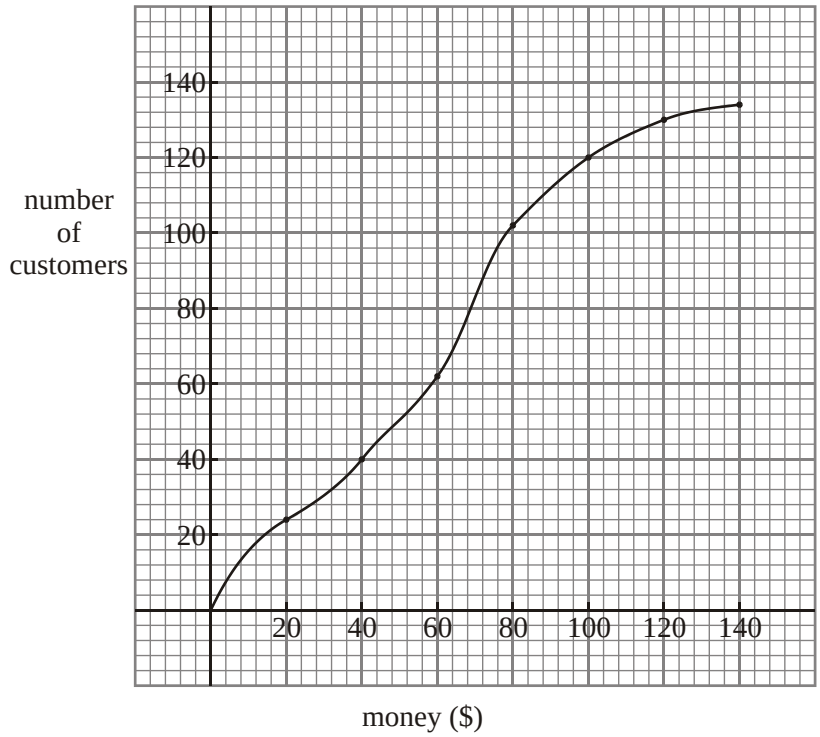
$=\frac{7860}{134}$

= \$59 (A1) 2

(b)

Money ($)	<20	<40	<60	<80	<100	<120	<140
Customers	24	40	**62**	**102**	**120**	**130**	**134**

(A1)



(A4) 5

Note: *Award (A1) for the correct scale, (A1) for the points, and (A2) for the curve.*

(c) (i) $t = 2d^{2/3} + 3$

Mean $d = 59$ (M1)

Mean $t \approx 2 \times (59)^{2/3} + 3$ (M1)

≈ 33.3 min. (3 sf) (accept 33.2) (A1)

(ii) $t > 37 \Rightarrow 2d^{2/3} + 3 > 37$ (M1)

$2d^{2/3} > 34$

$d^{2/3} > 17$ (A1)

$d > (17)^{3/2}$

$d > 70.1$

From the graph, when $d = 70.1$, $n = 82$ (A1)

number of shoppers = 134 – **82** (A1)

= **52** (A1) 8

[15]