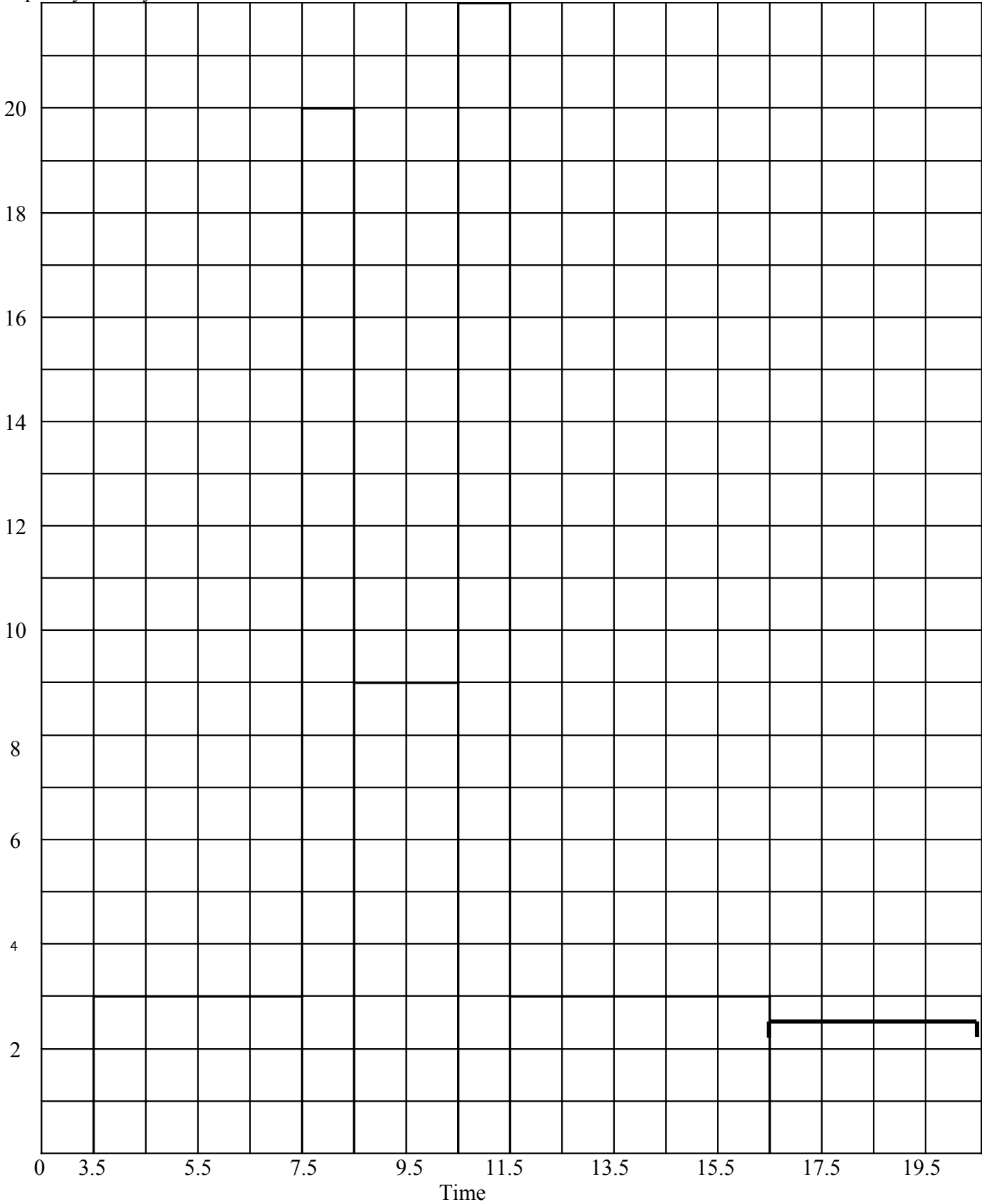
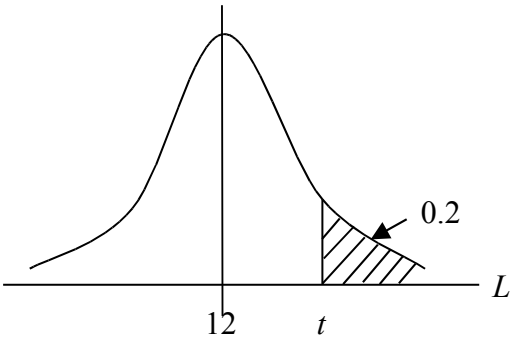


Question Number	Scheme	Marks
1.	Frequency densities: 3.0, 20.0, 9.0, 22.0, 3.0, 3.25 Graph (see page 2)	Can be implied from graph Scales and labels Bases Heights M1 A1 B1 B1 B1 <b>(5 marks)</b>

1.

Frequency density



Question Number	Scheme	Marks
2.	 <p>Let <math>L</math> represent lifetimes <math>\therefore L \sim N(12, 3^2)</math>  <math>P(L &gt; t) = 0.2</math>  <math>\therefore \frac{t - 12}{3} = 0.8416</math>  <math>\therefore t = 14.5248</math></p>	<p>M1  M1 B1 A1  M1 A1 (6)  <b>(6 marks)</b></p>
Alt	<p><math>P(L &gt; t) = 0.2</math>  <math>\therefore P(L \leq t) = 0.8</math>  <math>\therefore \frac{t - 12}{3} = 0.84(16)</math>  <math>\therefore t = 14.52(54)</math></p>	<p>M1  M1  B1 A1  M1 A1 (6)</p>
3.	<p>(a) <math>S_{xy} = 204.95 - \frac{48.1 \times 52.8}{7} = -157.86142</math> (awrt -157.9)  <math>S_{xx} = 155.92428</math> (awrt 155.9)  <math>S_{yy} = 214.95714</math> (awrt 215.0)</p> <p>(b) <math>r = \frac{-157.86142}{\sqrt{155.92428 \times 214.95714}}</math>  <math>= -0.862269</math> (awrt -0.862)</p> <p>(c)(i) -0.862  (ii) As sales at on petrol station increases, the other decreases; limited pool of customers; close one garage</p>	<p>M1 A1  A1  A1 (4)  M1 A1ft  A1 (3)  B1  B1 (2)  <b>(9 marks)</b></p>

(ft = follow through mark; awrt = anything which rounds to)

Question Number	Scheme	Marks								
<p>4. (a)</p> <p>(b)</p> <p>(c)</p>	$k(16 - 9) + k(25 - 9) + k(36 - 9) = 1$ $\therefore 7k + 16k + 27k = 1 \Rightarrow k = \frac{1}{50}$ <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 5px;"><math>x</math></td> <td style="padding: 5px; text-align: center;">4</td> <td style="padding: 5px; text-align: center;">5</td> <td style="padding: 5px; text-align: center;">6</td> </tr> <tr> <td style="padding: 5px;"><math>P(X = x)</math></td> <td style="padding: 5px; text-align: center;"><math>\frac{7}{50}</math></td> <td style="padding: 5px; text-align: center;"><math>\frac{16}{50}</math></td> <td style="padding: 5px; text-align: center;"><math>\frac{27}{50}</math></td> </tr> </table> $E(X) = (4 \times \frac{7}{50}) + (5 \times \frac{16}{50}) + (6 \times \frac{27}{50}) = \frac{270}{50} = 5.4$ $E(X^2) = (4^2 \times \frac{7}{50}) + (5^2 \times \frac{16}{50}) + (6^2 \times \frac{27}{50}) = \frac{1484}{50} = 29.68$ $\therefore \text{Var}(X) = 29.68 - 5.4^2$ $\text{Var}(2X - 3) = 2^2 \text{Var}(X)$ $= 4 \times 0.52 = 2.08$	$x$	4	5	6	$P(X = x)$	$\frac{7}{50}$	$\frac{16}{50}$	$\frac{27}{50}$	<p>M1 A1 A1 (3)</p> <p>M1 A1 M1 A1 M1 A1 (6) M1 A1 (2) <b>(11 marks)</b></p>
$x$	4	5	6							
$P(X = x)$	$\frac{7}{50}$	$\frac{16}{50}$	$\frac{27}{50}$							
<p>5. (a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p> <p>(e)</p>	<p>Discrete uniform</p> $P(X = x) = \frac{1}{6}, x = 1, 2, \dots, 6$ $\therefore E(X) = \sum x P(X = x) = \frac{1}{6} + \frac{2}{6} + \dots + \frac{6}{6} = \frac{21}{6} = 3.5$ $\text{Var}(X) = \sum x^2 P(X = x) - \{E(X)\}^2$ $= \frac{1}{6} + \frac{4}{6} + \dots + \frac{36}{6} - (\frac{21}{6})^2 = 2.91666\dots$ $P(\text{three 6s}) = (\frac{1}{6})^3 = \frac{1}{216}$ <p><math>16 \Rightarrow (6, 5, 5); (5, 6, 5); (5, 5, 6)</math> <math>(6, 6, 4); (6, 4, 6); (4, 6, 6)</math></p> $P(16) = \frac{6}{216} = \frac{1}{36}$	<p>B1 (1)</p> <p>B1 M1 A1 (3) M1 A1 (2) B1 B1 B1 B1 (4) M1 A1 (2) <b>(12 marks)</b></p>								

Question Number	Scheme	Marks																										
6. (a)	$\bar{x} = \frac{20 + 15 + \dots + 17}{14} = \frac{312}{14} = 22.2857\dots$	(awrt 22.3) M1 A1 (2)																										
(b)	<table style="border-collapse: collapse; margin-left: 20px;"> <tr> <td style="border-right: 1px solid black; padding: 2px;">Bags of crisps</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">0 means 10</td> <td style="padding: 2px;">Totals</td> <td></td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">0</td> <td style="padding: 2px;">5</td> <td></td> <td style="padding: 2px;">(1)</td> <td rowspan="5" style="padding: 2px; vertical-align: middle;">Label and key 2 correct rows All correct</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">1</td> <td style="padding: 2px;">0 1 3 5 7</td> <td></td> <td style="padding: 2px;">(5)</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">2</td> <td style="padding: 2px;">0 0 5</td> <td></td> <td style="padding: 2px;">(3)</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">3</td> <td style="padding: 2px;">0 1 3</td> <td></td> <td style="padding: 2px;">(3)</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">4</td> <td style="padding: 2px;">0 2</td> <td></td> <td style="padding: 2px;">(2)</td> </tr> </table>	Bags of crisps	1	0 means 10	Totals		0	5		(1)	Label and key 2 correct rows All correct	1	0 1 3 5 7		(5)	2	0 0 5		(3)	3	0 1 3		(3)	4	0 2		(2)	B1 B1 B1 (3)
Bags of crisps	1	0 means 10	Totals																									
0	5		(1)	Label and key 2 correct rows All correct																								
1	0 1 3 5 7		(5)																									
2	0 0 5		(3)																									
3	0 1 3		(3)																									
4	0 2		(2)																									
(c)	$Q_2 = 20; Q_1 = 13; Q_3 = 31$	B1; B1; B1 (3)																										
(d)	$1.5 \times \text{IQR} = 1.5 \times (31 - 13) = 27$ $31 + 27 = 58; 13 - 27 = -14$ No outliers	B1 both M1 A1 (3)																										
(e)	scale and label $Q_1 = 13, Q_2 = 20, Q_3 = 31$ Whiskers 5, 42;	B1 B1 ft B1																										
(f)	$Q_2 - Q_1 = 7; Q_3 - Q_2 = 11; Q_3 - Q_2 > Q_2 - Q_1$ Postive skew	M1 A1 (2) <b>(13 marks)</b>																										

Question Number	Scheme	Marks
7.	(a) $m$ is explanatory variable	B1 (1)
	(b) scales and labels points (7, 19), (8, 10), (9, 11), (10, 15), (13, 21), (14, 23), (17, 26), (20, 31)	B1 B2 (3)
	(c) $\Sigma m = 98$ ; $\Sigma p = 156$ ; $\Sigma m^2 = 1348$ ; $\Sigma mp = 2119$ $S_{mp} = 2119 - \frac{98 \times 156}{8} = 208$ $S_{mm} = 1348 - \frac{98^2}{8} = 147.5$ $\therefore b = \frac{S_{mp}}{S_{mm}} = \frac{208}{147.5} = 1.410169$ $a = \frac{156}{8} - (1.410169...) \times \frac{98}{8} = 2.225429$ $\therefore p = 2.23 + 1.41m$	(awrt 1.41) M1 A1 (awrt 2.23) M1 A1
	(d) Line on graph	A1 ft (8) M1 A1 (2)
	(e) $p = 2.23 + 1.41 \times 15 = 23.38$	M1 A1 (2)
		<b>(14 marks)</b>

(ft = follow through mark; -1 eoo = minus one mark for each error or omission)