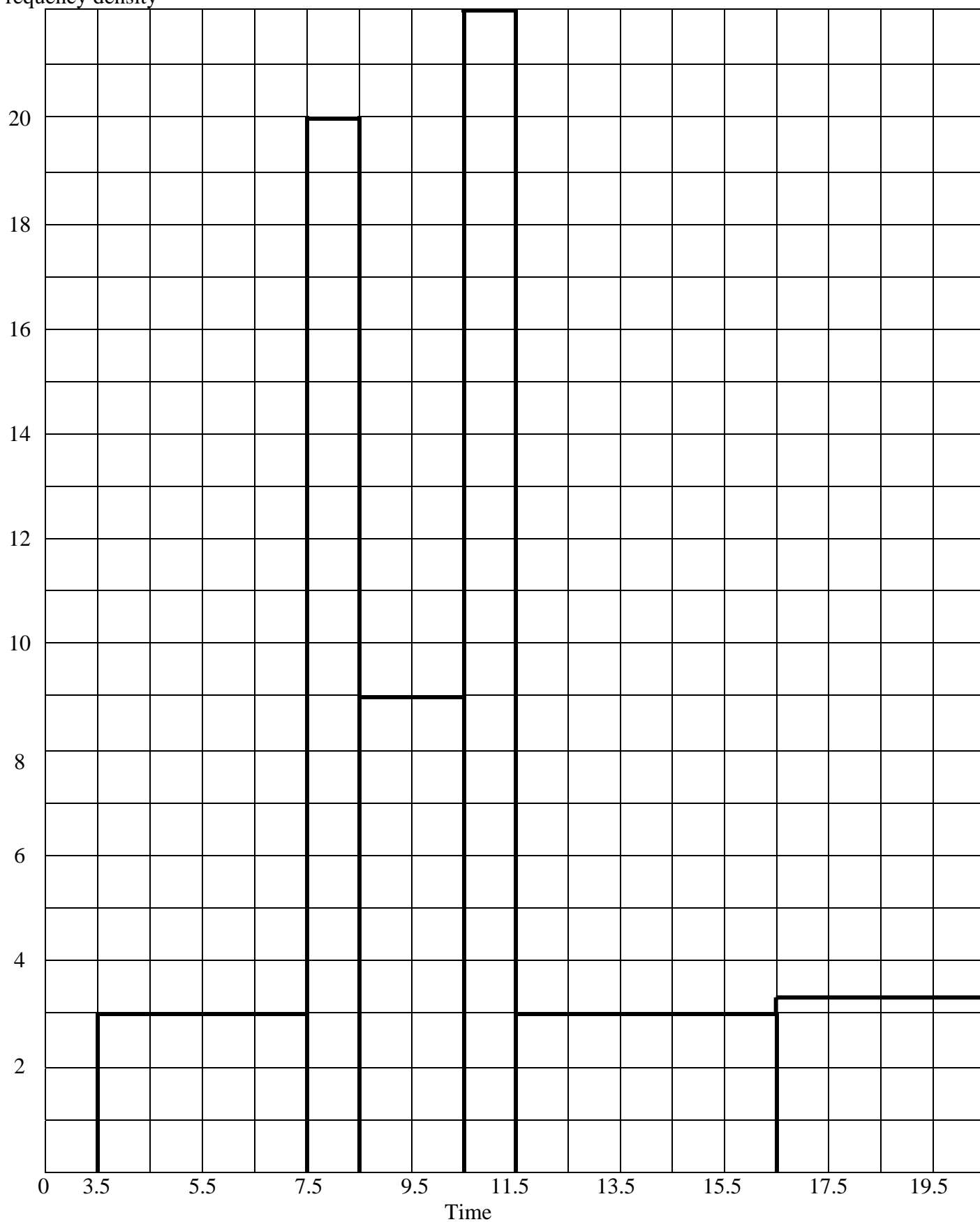
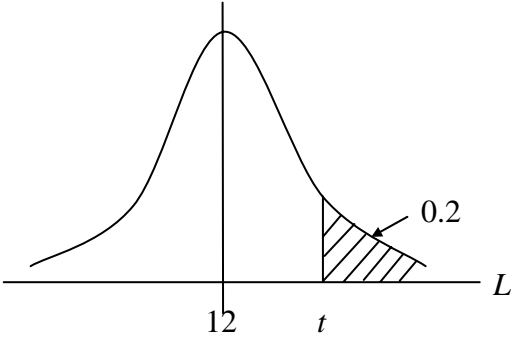




1.

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</p> <p>M1 B1 A1</p> <p>M1 A1 (6)</p> <p><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</p> <p>M1</p> <p>B1 A1</p> <p>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)</p> <p><math>S_{xx} = 155.92428</math> (awrt 155.9)</p> <p><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</p> <p>(ii) As sales at on petrol station increases, the other decreases; limited pool of customers; close one garage</p>	<p>M1 A1</p> <p>A1</p> <p>A1 (4)</p> <p>M1 A1ft</p> <p>A1 (3)</p> <p>B1</p> <p>B1 (2)</p> <p><b>(9 marks)</b></p>

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

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

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><tr><th>Bags of crisps</th><th>1</th><th>0 means 10</th><th>Totals</th></tr><tr><td>0</td><td>5</td><td></td><td>(1)</td></tr><tr><td>1</td><td>0 1 3 5 7</td><td></td><td>(5)</td></tr><tr><td>2</td><td>0 0 5</td><td></td><td>(3)</td></tr><tr><td>3</td><td>0 1 3</td><td></td><td>(3)</td></tr><tr><td>4</td><td>0 2</td><td></td><td>(2)</td></tr></table> Label and key 2 correct rows All correct	Bags of crisps	1	0 means 10	Totals	0	5		(1)	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)																							
	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)																									
(13 marks)																											

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