

1a	The data is from the same week in the same month – not random	B1
1b	<p>Hurn – Random sampling,</p> <ul style="list-style-type: none"> • Free of bias • Easy and cheap • Each sampling unit has an equal chance of selection • Not suitable for large population • A sampling frame is needed <p>Leeming – Systematic sampling</p> <ul style="list-style-type: none"> • Simple and quick to use • Suitable for large populations • A sampling frame is needed • It can introduce bias if the sampling frame is not random 	B1
1c	It is a very small sample	B1
1d	Heathrow is in the south of England in away from the coast	B1
1e	The mean and medians are relatively close.	B1
2a	$r = 0.7692$	M1A1
2b	$H_0: \rho = 0$ $H_0: \rho > 0$ $0.7692 > 0.7067$ $\therefore \text{reject null hypothesis}$ $\text{Teacher is correct}$	B1 hypotheses M1A1 A1
2c	$y = 3.4167x + 44.989$	
2d	3.4167 is how many marks you score for every hour of revision 44.989 is how many marks you would expect with no revision	B1 B1
2e	This is extrapolation	B1
3a	<ul style="list-style-type: none"> • Fixed amount of trials • Only two options • Independent probability 	B1
3b	$\left(\frac{65}{184}\right) \times 30 = 10.59$ 11 days	M1 A1
3c	$X \sim B(184, 0.353)$ $P(30 \leq X \leq 70)$ $= P(X \leq 70) - P(X \leq 29)$ $= 0.8024$	M1 A1
3d	0.353 is close enough to 0.5 184 is large enough	B1
3e	$X \sim N(65, 42)$ $P(59.5 \leq X \leq 70.5)$ $= 0.6037$	M1 M1A1 A1
3f	(One answer-the other)/(ans)*100 $= 0.0069\%$	M1 A1
3g	$H_0: p = 0.353$ $H_1: p \neq 0.353$ $X \sim B(14, 0.353)$ $P(X \geq 9) = 1 - P(X \leq 8)$ $= 0.0258$	B1 M1 A1

	$0.0258 > 0.025$ Alternative: CR $X \leq 1, X \geq 10$ 9 not in CR \therefore insufficient evidence to reject H_0 \therefore claim is incorrect	A1
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4a		$P(A \cap B \cap C) = 0$ B1 2 of $P(A \cap B) = 24$ $P(B \cap C) = 6$ $P(A \cap B) = 0$ B1 2 of $P(A) = 40$ $P(B) = 50$ $P(C) = 20$ B1 correct answer including 25 out of circles
4b	$P(\text{shoes} \text{bag}) = \frac{P(\text{shoes} \cap \text{bag})}{P(\text{bag})} = \frac{24}{50}$	M1A1
4c	$P(\text{shoes} \text{bag}) = 0.48$ $P(\text{shoes}) = 0.48$ $P(\text{shoes}) = P(\text{shoes} \text{bag})$ \therefore independent	M1 A1
5a	$X \sim N(\mu, 18^2)$ $P(X > 80) = 0.75$ $P\left(X > \frac{80 - \mu}{18}\right) = 0.75$ $\frac{80 - \mu}{18} = -0.674$ $\mu = 92.14$	M1A1 M1 A1
5b	$H_0: \mu = 92.14$ $H_1: \mu < 92.14$ $X \sim N\left(92.14, \frac{18^2}{7}\right)$ $CR X < 80.9$ 80 is in CR \therefore reject null hypothesis \therefore person is correct	B1 M1 M1 A1

1a	$s = ut + \frac{1}{2}at^2$ $3 = u_y 2.5 + \frac{1}{2}(-9.8)(2.5)^2$ $u_y = 13.45$ $42 = u_x(2.5)$ $u_x = 16.8$	M1A1 A1 A1
1b	$v = u + at$ $v = 13.45 - 9.8(2.5)$ $v = -11.05$ $v = \sqrt{16.8^2 + (11.05)^2}$ $v = 20.1$ $\tan \theta = \frac{11.05}{16.8}$ $\theta = 33.5$	M1A1 M1A1 M1A1
2a	$v = u + at$ $0 = 15 + (-2.5)t$ $t = 6$	
2b		

(c)	$\frac{1}{2}15\left(\frac{4}{3}T + 6 + T\right) = 885$ $\frac{7}{3}T = 118 - 6$ $T = 112 \times \frac{3}{7} = 48$	ft their 6	M1 A1 ft
(d)	$a = \frac{15}{\frac{1}{3}T} = \frac{15}{16}, 0.9375, 0.938, 0.94$	M1 A1	(4)
(e)	<p style="text-align: center;">3 horizontal lines Correctly placed; no cts vert line -2.5, ft their $\frac{15}{16}$</p>	B1 B1 B1	(2) (3)

(13 marks)

Question Number	Scheme	Marks
8.		
(a)	For A, $T = 2ma$	B1
	For B, $3mg - T = 3ma$	M1 A1
	$3mg = 5ma$	DM1
	$\frac{3g}{5} = a \quad (5.9 \text{ or } 5.88 \text{ m s}^{-2})$	A1
		(5)
(b)	$T = 6mg/5; 12m; 11.8m$	B1
		(1)
(c)	$F = \sqrt{T^2 + T^2}$	M1 A1 ft
	$F = \frac{6mg\sqrt{2}}{5}; 1.7mg \text{ (or better)}; 16.6m; 17m$	A1
	Direction clearly marked on a diagram, with an arrow, and 45° (oe) marked	B1
		(4)
		[10]

4a	$\frac{dv}{dt} = 2t + k$ $2t + k = 0$ $2(2.4) + k = 0$ $k = -4.8$	
4b	$0 = t^2 + kt + 3.2$ $t = 4 \text{ or } \frac{4}{5}$	
4c	$\int_0^{0.8} t^2 - 4.8t + 3.2 dt + \int_{0.8}^4 t^2 - 4.8t + 3.2 dt + \int_4^{6.8} t^2 - 4.8t + 3.2 dt$ $= \left[\frac{1}{3}t^3 - 2.4t^2 + 3.2t \right]_0^{0.8} + \left[\frac{1}{3}t^3 - 2.4t^2 + 3.2t \right]_{0.8}^4 + \left[\frac{1}{3}t^3 - 2.4t^2 + 3.2t \right]_4^{6.8}$ $= 15.7$	M1 (three sections) M1A1 integration M1 definite integration A1

Question Number	Scheme	Marks
3.		
(a)	$R = F$ $S + Q = mg$ $Q = \frac{2}{3}R, \quad F = \frac{1}{4}S$ $Q = \frac{2}{3}R = \frac{2}{3} \times \frac{1}{4}S, \quad S + \frac{1}{6}S = mg, \quad S = \frac{6}{7}mg$	B1 B1 B1 M1 A1 (5)
(b)	$M(A) \quad mg \times x \cos 60^\circ = Q \times 2l \cos 60^\circ + R \times 2l \sin 60^\circ$ $M(B) \quad mg(2l - x) \cos 60^\circ + F \times 2l \sin 60^\circ = S \times 2l \cos 60^\circ$ $M(c \text{ of } m) \quad Sx \cos 60^\circ = Fx \sin 60^\circ + R(2l - x) \sin 60^\circ + Q(2l - x) \cos 60^\circ$ $mgx \cos 60^\circ = \frac{1}{6} \times \frac{6}{7}mg \times 2l \cos 60^\circ + \frac{1}{4} \times \frac{6}{7}mg \times 2l \sin 60^\circ$ $\frac{1}{2}x = \frac{1}{7} \times 2l \times \frac{1}{2} + \frac{3}{14} \times l\sqrt{3}$ $AG = x = 1.028 \dots \therefore x = 1.03l$	M1 M1 A2 DM1 A1 (5)