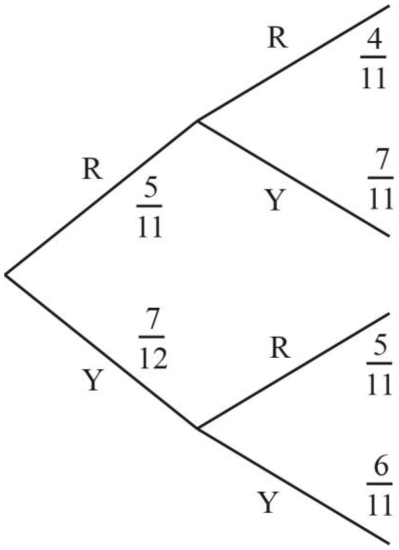
Q	Answer	Mark	Comments
1 a		B1 B1	Basic structure and first level probabilities correct Complete set of correct second level probabilities
b	$\frac{5}{12}\times\frac{7}{11}+\frac{7}{12}\times\frac{5}{11}=\frac{35}{66}$	M1 M1 A1	Any correct multiplication Adding terms Accept unsimplified fraction
c	$\frac{5}{12}\times\frac{4}{11}\times\frac{3}{10}+\frac{7}{12}\times\frac{6}{11}\times\frac{5}{10}=\frac{9}{44}$	M1 M1 A1	Any correct multiplication Adding terms Accept unsimplified fraction
2 a	$\bar{x}=18.6$ °C $\sigma=3.17$	B1 B1	
b	$\bar{x}=\frac{\bar{y}+4}{3}=22.2$ $\sigma_x=\frac{\sigma_y}{3}=3.50$	M1 A1 M1 A1	
c	The maximum daily temperatures in June 2015 are on average higher than June 1987, but also have a greater spread.	B1	

3 a	Variance $= \dfrac{\sum x^2}{n} - \left(\dfrac{\sum x}{n}\right)^2$ $\dfrac{\sum x^2}{5} - \left(\dfrac{43}{5}\right)^2 = 6.64$ $\sum x^2 = 5\left(6.64 + \left(\dfrac{43}{5}\right)^2\right) = 403$	 M1 Correct expression including substituted values A1 Correct solution
b	$\sigma_y{}^2 = 10^2 \times \sigma_x{}^2$ $\sigma_x{}^2 = \dfrac{\sigma_y{}^2}{10^2}$ $\sigma_x{}^2 = \dfrac{458.8}{10^2} = 4.59$ (to 3 sf) The second set of data is less spread out than the first set.	M1 Correct conversion formula A1 A1 Correct comparison.
4 a	B(20, 0.15)	B1
b i	${}^{20}C_2 (0.15)^2 (0.85)^{18} = 0.2293$	M1 A1
b ii	$1 - P(X \leq 3) = 1 - 0.6477 = 0.3523$	M1 A1
c	H_0: $p = 0.15$ H_1: $p \neq 0.15$ Assuming $X \sim B(25, 0.15)$ for new sample, $P(X \leq 1) = 0.0931$ 0.0931 > 0.05 (half of 10% sig. level) So accept H_0 There is insufficient evidence at the 10% significance level to suggest the new process has altered the number of flawed jugs.	B1 For both M1 A1 A1 A1

5 a	$s = ut + \frac{1}{2}at^2$ $30 = 0 + \frac{1}{2} \times 9.81 \times t^2$ $t = \sqrt{\frac{30}{4.905}} = 2.47$ seconds (to 3 sf)	 M1 A1	 Correct equation
b	$v^2 = u^2 + 2as$ $v^2 = 0 + 2 \times 9.81 \times 30$ $v = \sqrt{588.6} = 24.3\text{ ms}^{-1}$	 M1 A1	 Or equivalent method
c	Assuming no air resistance or wind OR The stone is modelled as a particle which has no size and doesn't spin	B1	
6	For P: $s = 5 \times 15 + \frac{1}{2} \times 2 \times 15^2$ $s = 300$ m For Q: $s = 6 \times 13$ $s = 78$ m Distance between *P*&*Q* $= 300 - 78 = 222$ m	M1 A1 M1 A1 A1	Use of $s = ut + \frac{1}{2}at^2$ (with $t = 15$ s) to find distance *P* travels past *A* Use of $s = vt$ (with $t = 13$ s) to find distance *Q* travels past *A*
7 a	$v = \int a \, dt = \int (2 + 3t) dt$ $v = 2t + \frac{3}{2}t^2 + c$ $2 = 2(0) + \frac{3}{2}(0)^2 + c \Rightarrow c = 2$ $v = 2t + \frac{3}{2}t^2 + 2$	M1 A1 M1 A1	 Use v = 2 at t = 0 to calculate c
b	$s = \int_1^5 \left(2t + \frac{3}{2}t^2 + 2 \right) dt$ $s = \left[t^2 + \frac{1}{2}t^3 + 2t \right]_1^5$ $s = 97.5 - 3.5 = 94$ m	M1 A1 M1 A1	Attempt to integrate with correct limits Expression integrated correctly

8 **a**	At Q:		
	$7g - T = 7a$ *(1)*	M1	Use of $F = ma$ at P
	At P:		
	$T - 2g = 2a$ *(2)*	M1	Use of $F = ma$ at Q
	(1) + (2) $\Rightarrow 5g = 9a$	M1	Solve simultaneous equations by elimination or substitution
	$a = \frac{5g}{9} = \frac{50}{9}$ m s^{-2} in the direction of Q downwards	A1	Must state magnitude and direction
	$T = \frac{280}{9}$ N	A1	Accept $31\frac{1}{9}$ N or 31.1 N
b	Tension is constant throughout the length of the string.	B1	
9	$3 - 2 + a = 0 \Rightarrow a = -1$	M1	Both a and b required
	$2 + 4 + b = 0 \Rightarrow b = -6$		
	$F_3 = -\mathbf{i} - 6\mathbf{j}$	A1	
	Magnitude $= \sqrt{1^2 + 6^2} = \sqrt{37}$ N	M1 A1	Accept decimal equivalent (6.08 or better)
	$\tan^{-1}\left(\frac{6}{1}\right) = 80.5°$	M1	
	Direction = –99.5° to **i**	A1	Direction must be specified relative to **i** (or **j**)