AS Level
Maths

Bronze Set B, Paper 2 (Edexcel version)

Question	Solution	Partial Marks	Guidance
1 (a)	Probability of not picking an empty disk is 0.9 So probability of none of the disks being empty is $0.9^{30} = 0.04239...$	M1 A1 **[2]**	Seen or implied Correct probability. Awrt 0.0423
1 (b)	Let X be the no. of disks that are empty, then $X \sim B(30, 0.1)$ $P(X \leq 2) = P(X = 2) + P(X = 1) + P(X = 0)$ $= {}^{30}C_2(0.1)^2(0.9)^{28} + {}^{30}C_1(0.1)^1(0.9)^{29} + 0.9^{30}$ $= 0.411351...$	B1 M1 A1 **[3]**	Uses correct binomial model (can be implied) Complete method to find P($X \leq 2$). Must also see method to find the probabilities (i.e. at least two probabilities written out, unsimplified or better) If they use a calculator to find the probabilities, two must be written down correctly Correct probability. Awrt 0.411
2 (a)	Testing light bulbs would lead to their destruction (and destroying all their products would not be feasible for the factory)	B1 **[1]**	Correct reason Ignore general references to it being quicker or cheaper – candidates need to answer in the context of this factory
2 (b)	Let X be the number of light bulbs in the sample that are faulty. Then $X \sim B(100, p)$ $H_0 : p = 0.0125$, $H_1 : p > 0.0125$ $P(X \geq 3) = 0.1304...$ $0.1304 > 0.05$, so insufficient evidence to reject the null hypothesis So there is insufficient evidence to suggest the **customer's claim** is correct / the **proportion** of **lightbulbs** that are faulty is higher	B1 B1 M1 A1ft A1 **[5]**	Uses correct binomial model, seen or implied Explicitly states the hypotheses Attempts to find $P(\geq 3)$ or the critical region (which is ≥ 4) Correct comparison and conclusion ft their 0.1304… Conclusion in context

3 (a)	$\sum f = 77$, so median is the 38.5^{th} value which lies in the 3^{rd} class $\frac{20-10}{m-10} = \frac{77-35}{38.5-35}$ $\Rightarrow m = 10.8333...$	B1 M1 A1 **[3]**	Median lies in 3^{rd} class Complete attempt at linear interpolation Allow use of 9.5, 10, 10.5, 19.5, 20, 20.5 for class boundaries Correct median **Use of (n + 1) gives 10.952… and scores 3/3**
3 (b)	$\bar{t} = \frac{777.5}{77} = 10.097...$ standard deviation is $\sigma_t = \sqrt{\frac{10268.75}{77} - (10.097...)^2}$ $= 5.6038...$	B1 M1 A1 **[3]**	Correct mean, awrt 10.1 Complete method to find the standard deviation ft their mean Allow omission of √ for the M1 Correct standard deviation
3 (c)	Let t be the old times and t^* be the converted times, then the data is coded according to $t^* = 60t - 20$ Mean is 60(10.097…) – 20 = **<u>585.8… s</u>** Standard deviation is 60(5.6038…) = **<u>336.2…s</u>**	M1 A1 A1 **[3]**	Correct method to find the mean ***OR*** standard deviation using the correct coding relationship (can be implied) and their (b) Correct mean Correct standard deviation If candidates answer in minutes, we are allowing A1A1 but they need to write in the units. No units is A0A0

4 (a)	**For *T*,** IQR = 3.3 Then 1.5 × IQR = 4.95 14.5 – 4.95 = 9.55 and 17.8 + 4.95 = 22.75 There are no values of *T* less than 9.55 or greater than 22.75 so no outliers for *T* **For *r*,** IQR = 8.3 Then 1.5 × IQR = 12.45 1.8 – 12.45 = –10.65 and 10.1 + 12.45 = 22.55 There are no values of *r* less than –10.65 or greater than 22.55 so no outliers for *r*	B1 B1 **[2]**	Convincingly shows there are no outliers for *T* Convincingly shows there are no outliers for *r*
4 (b)	The data set has lots of 0s for *r* / data values less than 1 mm but Nikita's sample has none	B1 **[1]**	Convincing reason Allow a comment on the lines of 'values of *r* are all (quite) high'
4 (c)	***EITHER*** • Figure 1 suggests/shows a positive correlation between **temperature** and **rainfall** ***OR*** • Figure 1 suggests/shows that as the amount of **temperature** increases, the amount of **rainfall** increases	B1 **[1]**	A reason that comments on the nature of the relationship that Figure 1 shows between rainfall and temperature 'Figure 1 shows a relationship between rainfall and temperature' is ^B0 (too vague)
4 (d)	For every 1°C increase in the **temperature**, the amount of **rainfall** (in Leeming in 2015) decreases by 0.0424 mm	B1 **[1]**	Interpretation (must see use of units) Allow increase by –0.0424
4 (e)	Not suitable because the data shows no correlation / relationship	B1 **[1]**	Not suitable + reason
4 (f) (i)	e.g. Figure 1 suggests positive correlation, while Figure 2 does not / Figure 2 has a lot of zeros/small accounts of rainfall, while Figure 1 does not	B1 **[1]**	For any inconsistency identified

4 (f) (ii)	Use a larger sample size	B1 **[1]**	Improvement No reference to using a random sample (there is only suspicion that the sample is not random)
4 (g)	Any **two** from: • Large data set only has information from a few regions / not representative of the world • Large data set only contains data from 2015 and 1998 (so cannot use to gain data over a 10 year period) • Large data set only has data for March-October • Large data set has gaps / small amounts of rainfall are identified as 'tr' (so may affect ability to compare low amounts of rainfall)	B1 B1 **[2]**	One mark for each correct limitation (max. 2) Points do not have to be worded exactly as in the mark scheme so long as they convey the main idea
5 (a)	$\sqrt{6^2+(-9)^2} = 3\sqrt{13}$ m/s	B1 **[1]**	Correct speed
5 (b)	$\tan^{-1}\left(\frac{9}{6}\right) = 56.309...$ so bearing of the boat is 90 + 56.309… = 146 (nearest degree)	M1 A1 **[2]**	Considers arctan(9/6) or arctan(6/9) Correct bearing given to the nearest degree
5 (c)	$k = \frac{3}{2}$	B1 **[1]**	Correct value of k
6 (a)	Gradient of line is $\frac{960}{20} = 48$, so $F = 48t$ Since $F = 800a$, we have $800a = 48t$ $\Rightarrow a = \frac{48}{800}t$ $\Rightarrow a = \frac{3}{50}t$ **AG**	M1 A1 **[2]**	Attempts to express F in terms of t and then using N2L **ALT:** M1 for $F = 960 \Rightarrow a = 960/800 = 1.2$ Then they should work out the gradient of the line to express a in terms of t Obtains the given result convincingly

6 (b)	$v = \int a\,dt = \frac{3}{100}t^2 + c$ At $t = 0$, $v = 8$, so $c = 8 \Rightarrow v = \frac{3}{100}t^2 + 8$ Distance travelled by car in 20 second period given by $s = \int_0^{20} v\,dt$ $= \left[\frac{1}{100}t^3 + 8t\right]_0^{20}$ $= \frac{1}{100}(20)^3 + 8(20) - 0$ $= 240$ m	M1* A1 M1**(dep*) M1(dep**) A1 **[5]**	Shows intention to integrate to find v in terms of t Obtains v in terms of t correctly with the constant determined Integrates their v with respect to t to find an expression for the displacement of the particle (limits do not need to be seen) Substitutes in the correct limits in the correct order Obtains correct distance
7 (a)	$a = \frac{7-2}{4} = \frac{5}{4}$ m/s^2	B1 **[1]**	Correct acceleration
7 (b)	$R(\uparrow^+)$: $R - 4g = 0 \Rightarrow R = 4g$ $R(\rightarrow^+)$: $10 - \mu(4g) = 4\left(\frac{5}{4}\right)$ $\Rightarrow \mu = 0.1275...$	B1 M1* A1ft M1(dep*) A1 **[5]**	Correct normal reaction force Resolves vertically (allow if it is in terms of R) Correct resolution with their value of R replaced Attempts to solve their equation for μ Correct value of μ. Accept 0.13 or 0.128 **[Reminder: as usual, for the award of M marks, resolutions need correct no. of terms and to be dimensionally correct]**
8 (a)	Considering the whole system gives $T - (0.2 + 0.8)g = (0.2 + 0.8)(3)$ $\Rightarrow T = 12.8$ N, (so the tension in the string is 13 N to 2sf)	M1 A1 **[2]**	Considers the whole system and resolves vertically Correct tension to two or three significant figures

8 (b)	Considering A gives $R - 0.2g = 0.2(3)$ $\Rightarrow R = 2.56$ N, (so the magnitude of the force exerted on A by B is 2.6 N to 2 sf)	M1 A1 A1 **[3]**	Considers A and resolves vertically Correct resolution Correct magnitude of the force exerted on A by B to two or three significant figures
8 (c)	(By Newton's third law, the magnitude of the force exerted on B by A is) **2.6 N** (to 2 sf)	B1ft **[1]**	Correct force ft their (b)
8 (d)	Neglected the mass of the lift (in the resolutions)/took the mass of the lift to be 0 (in the resolutions)	B1 **[1]**	Correct explanation
9 (a)	In the case $v = 0$, $0^2 = u^2 + 2(-g)(10)$ $\Rightarrow u = \sqrt{20g} = 2\sqrt{5g}$ (so $2\sqrt{5g}$ is the minimum initial speed required for the ball to reach P,) hence $u \geq 2\sqrt{5g}$ (or $u \geq 14$)	M1 A1 **[2]**	Attempts to find the minimum initial speed required for the ball to pass through P Obtains the result Allow the use of a strict inequality
9 (b)	$2 = 20t + \frac{1}{2}(-g)t^2 \Rightarrow 4.9t^2 - 20t + 2 = 0$ $t = \frac{-(-20) \pm \sqrt{(-20)^2 - 4(4.9)(2)}}{2(4.9)} = 0.1025...$ or $3.9790...$ so the length of time is 3.970 – 0.1025 = **3.9 s** to 2 sf	M1* A1 M1(dep*) A1 **[4]**	Uses $s = ut + \frac{1}{2}at^2$ You are only condoning sign errors and use of $s = 12$ Obtains the correct 3TQ Complete method to solve **their** 3TQ **and** find the length of time for which the particle is 12 m above the ground M0 if they used $a = g$ (solutions don't make sense) Correct interval of time to two or three significant figures