



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS (US)

9280/06

Paper 6 Probability and Statistics 1 **(S1)**

For Examination from 2013

SPECIMEN MARK SCHEME

1 hour 15 minutes

MAXIMUM MARK: 50

This document consists of **5** printed pages and **1** blank page.



Mark Scheme Notes

Marks are of the following three types:

M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark, and in some cases an M mark can be implied from a correct answer.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).

B Mark for a correct result or statement independent of method marks.

- When a part of a question has two or more “method” steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly when there are several B marks allocated. The notation DM or DB (or dep*) is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.
- The symbol ∇ implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only. A and B marks are not given for fortuitously “correct” answers or results obtained from incorrect working.
- Note: B2 or A2 means that the candidate can earn 2 or 0.
B2/1/0 means that the candidate can earn anything from 0 to 2.

The marks indicated in the scheme may not be subdivided. If there is genuine doubt whether a candidate has earned a mark, allow the candidate the benefit of the doubt. Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored.

- Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise.
- For a numerical answer, allow the A or B mark if a value is obtained that is correct to 3 s.f., or that would be correct to 3 s.f. if rounded (1 d.p. in the case of an angle). As stated above, an A or B mark is not given if a correct numerical answer arises fortuitously from incorrect working. For Mechanics questions, allow A or B marks for correct answers that arise from taking g equal to 9.8 or 9.81 instead of 10.

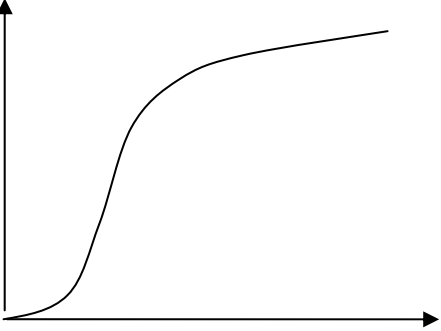
The following abbreviations may be used in a mark scheme or used on the scripts:

AEF	Any Equivalent Form (of answer is equally acceptable)
AG	Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
BOD	Benefit of Doubt (allowed when the validity of a solution may not be absolutely clear)
CAO	Correct Answer Only (emphasizing that no “follow through” from a previous error is allowed)
CWO	Correct Working Only often written by a “fortuitous” answer
ISW	Ignore Subsequent Working
MR	Misread
PA	Premature Approximation (resulting in basically correct work that is insufficiently accurate)
SOS	See Other Solution (the candidate makes a better attempt at the same question)
SR	Special Ruling (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)

Penalties

- MR –1 A penalty of MR –1 is deducted from A or B marks when the data of a question or part question are genuinely misread and the object and difficulty of the question remain unaltered. In this case all A and B marks then become “follow through \checkmark ” marks. MR is not applied when the candidate misreads their own figures – this is regarded as an error in accuracy. An MR–2 penalty may be applied in particular cases if agreed at the coordination meeting.
- PA –1 This is deducted from A or B marks in the case of premature approximation. The PA –1 penalty is usually discussed at the meeting.

<p>1 $18p = 2.7$ $p = 0.15$ $P(2, 3, 4) =$ ${}^{18}C_2 \times (0.15)^2(0.85)^{16} + {}^{18}C_3(0.15)^3(0.85)^{15}$ $+ {}^{18}C_4(0.15)^4(0.85)^{14}$ $= 0.655$</p>	<p>B1 M1 A1 A1 [4]</p>	<p>Correct value for p Summing 3 binomial probs o.e Correct unsimplified answer Correct answer</p>
<p>2 $P(\text{pencil case} \mid \text{find}) =$ $\frac{P(\text{pencilcase and find})}{P(\text{find})} = \frac{0.7 \times 1}{0.7 + 0.3 \times 0.2}$ $= 0.921$</p>	<p>M1 A1 A1 A1 [4]</p>	<p>Attempt to use cond prob formula, must be quotient Correct num of a fraction Correct denominator Correct answer</p>
<p>3 (i) $P(\text{any other number}) = 9/70$ $P(X < 2) = 27/70 + 1/10$ $= 34/70$ (17/35) (0.486)</p> <hr/> <p>(ii) $E(X) = 108/70$ (54/35) (1.543) $\text{Var}(X) = ((-2)^2 + \dots + 5^2) \times 9 / 70 - (54/35)^2$ $= 5.33$</p> <hr/> <p>(iii) $a = 1$</p>	<p>B1 B1 [2] M1 M1 A1 [3] B1 [1]</p>	<p>9/70 Seen ✂ their probs if < 1 Valid attempt at $E(X)$ (needn't be accurate) Using a variance formula correctly with mean² subtracted numerically, no extra division Correct final answer</p>
<p>4 (i) Options 5 bat 5 bl 1 Wk in ${}^{10}C_5 \times {}^9C_5 \times {}^2C_1 = 63504$ ways or 5 bat 4 bl 2 Wk in ${}^{10}C_5 \times {}^9C_4 \times {}^2C_2 = 31752$ ways or 6 bat 4 bl 1 Wk in ${}^{10}C_6 \times {}^9C_4 \times {}^2C_1 = 52920$ ways Total = 148176 (148000)</p> <hr/> <p>(ii) $\frac{11!}{5!4!2!} = 6930$</p> <hr/> <p>(iii) Omit a pen $\frac{10!}{4!4!2!} = 3150$ Omit a calendar $\frac{10!}{5!3!2!} = 2520$ Omit a notebook $\frac{10!}{5!4!} = 1260$ Total = 6930</p>	<p>M1 M1 A1 A1 [4] B1 [1] M1 B1 A1 [3]</p>	<p>Multiplying three combinations together Summing more than one sensible option Two options correct unsimplified Correct final answer Correct answer evaluated Summing three options One option correct Correct final answer</p>

<p>5 (a) $z > \frac{2\mu - \mu}{\sigma} = \frac{\mu}{\sigma} = \frac{7\sigma^2}{3\sigma}$</p> $\frac{7\sigma}{3} = 1.272$ $\sigma = 0.545$ $\mu = 0.693$	<p>M1</p> <p>M1</p> <p>B1</p> <p>A1</p> <p>[4]</p>	<p>Standardizing attempt resulting in $z > \text{some } \mu/\sigma$</p> <p>Substituting to eliminate μ or σ</p> <p>1.272 seen</p> <p>Both answers correct</p>
<p>(b) $P(X < a + 33) = 0.75$</p> $z = 0.674$ $\frac{a + 33 - 33}{\sqrt{21}} = 0.674$ $a = 3.09$	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>[4]</p>	<p>Using 0.75 oe ± 0.674 seen</p> <p>Standardizing, no cc, must have sq rt</p> <p>Correct answer</p>
<p>6 (i)</p>  <p>Median 270</p>	<p>M1</p> <p>M1 (Indpt)</p> <p>A1</p> <p>[3]</p>	<p>Sensible attempt at graph using u.c.b.</p> <p>2500 seen in median attempt on a CF graph</p> <p>Can be implied</p> <p>Correct answer + or - 5</p>
<p>(ii) 20% less than 160</p>	<p>M1</p> <p>A1</p> <p>[2]</p>	<p>Using 20%</p> <p>Correct answer + or - 5</p>
<p>(iii) $2100 - 1600 = 500$</p>	<p>B1</p> <p>[1]</p>	
<p>(iv) $(50.5 \times 200 + 125.5 \times 600 + 175.5 \times 800 + 225.5 \times 500 + 300.5 \times 2000 + 400.5 \times 600 + 525.5 \times 300) / 5000$</p> $= 268$	<p>M1</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>[4]</p>	<p>Using an attempt at mid points</p> <p>Using an attempt at frequencies</p> <p>Correct mid points or frequencies</p> <p>Correct answer only</p>
<p>7 (a) (i) $P(\text{at least one 3}) = 1 - P(\text{no 3s})$</p> $= 1 - (5/6)^9$ $= 0.806$	<p>M1</p> <p>A1</p> <p>[2]</p>	<p>Using $1 - \text{none}$</p> <p>Correct answer</p>
<p>(ii) $P(\text{at least 1 three}) = 1 - (5/6)^n$</p> $1 - (5/6)^n > 0.9$ $n > 12.6$ $n = 13$	<p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>[4]</p>	<p>Equation or inequality involving n and 0.9</p> <p>Solving attempt of sensible equation, can be trial</p> <p>Correct answer</p>
<p>(b) $P(\text{R wins his 1}^{\text{st}} \text{ ball}) = P(\text{GY})$</p> $= 15/56 (0.268)$ $P(\text{R wins 2}^{\text{nd}} \text{ ball}) = P(\text{GGGY}) = 3/28$ $P(\text{R wins 3rd ball}) = P(\text{GGGGY})$ $\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6} \times \frac{2}{5} \times \frac{1}{4} \times \frac{3}{3} = 1/56$ $P(\text{R wins}) = 11/28 (0.393)$	<p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>[4]</p>	<p>Using $P(\text{GY})$</p> <p>Attempt to find $P(\text{GGGY})$ or $P(\text{GGGGY})$</p> <p>Adding three options</p> <p>Correct answer</p>

