

Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCE Mathematics/Further Mathematics

Statistics 1 (6683/01)



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Summer 2017
Publications Code xxxxxxxx*

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

PEARSON EDEXCEL GCE MATHEMATICS

General Instructions for Marking

- 1. The total number of marks for the paper is 75
- 2. The Edexcel Mathematics mark schemes use the following types of marks:
- M marks: Method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
- A marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
- B marks are unconditional accuracy marks (independent of M marks)
- Marks should not be subdivided.

3. Abbreviations

These are some of the traditional marking abbreviations that will appear in the mark schemes.

- bod benefit of doubt
- ft follow through
- the symbol $\sqrt{}$ will be used for correct ft
- cao correct answer only
- cso correct solution only. There must be no errors in this part of the question to obtain this mark
- isw ignore subsequent working
- awrt answers which round to
- SC: special case
- oe or equivalent (and appropriate)
- d... or dep dependent
- indep independent
- dp decimal places
- sf significant figures
- * The answer is printed on the paper or ag- answer given
- L or d... The second mark is dependent on gaining the first mark

- 4. All A marks are 'correct answer only' (cao.), unless shown, for example, as A1 ft to indicate that previous wrong working is to be followed through. After a misread however, the subsequent A marks affected are treated as A ft.
- 5. For misreading which does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, in that part of the question affected.
- 6. If a candidate makes more than one attempt at any question:
 - If all but one attempt is crossed out, mark the attempt which is NOT crossed out.
 - If either all attempts are crossed out or none are crossed out, mark all the attempts and score the highest single attempt.
- 7. Ignore wrong working or incorrect statements following a correct answer.

Question Number	Scheme	Marks
1. (a)	$[S_{wt}] = 784 - \frac{119 \times 42}{6} =, \underline{-49}$	A1
	$[S_{tt}] = 2435 - \frac{119^2}{6} =$, $74.8\dot{3}$ or $74\frac{5}{6}$ or $\frac{449}{6}$ (accept awrt $\underline{74.8}$)	M1 A1
(b)	$S_{ss} = 5 \times 10^7$ or $50\ 000\ 000$ (o.e.) $S_{st} = -49\ 000$	(3) B1 B1ft (2)
(c)	$r = \frac{\text{"-49"}}{\sqrt{50 \times \text{"74.83"}}} \text{ or } \frac{\text{"-49 000"}}{\sqrt{\text{"5} \times 10^7 \text{"} \times \text{"74.83"}}} = \text{-0.80105} = \text{awrt } \underline{-0.801}$	M1, A1
(d)	r is close to -1 or $ r $ is close to 1 or "strong" (o.e.) [negative] correlation so "yes" or does support the belief	(2) B1ft (1)
(e)	$b = \frac{\text{"-}49\text{"}}{\text{"}74.8\dot{3}\text{"}} = [-0.6547], \ a = \frac{42}{6} - b \times \frac{119}{6} = [19.9866] \ \underline{\text{or}} \ a = 7 - b \times 19.8\dot{3}$	M1, M1
	So $w = 20.0 - 0.655t$	A1 (3)
(f)	$\underline{s} = 20\ 000 - 655t$ or $\underline{c} = 20\ 000$ and $d = -655$	B1ft B1ft
(g)	Decrease in sales of [£] 655 (ignore any minus sign)	B1ft (2)
	Notes	[14]
(a)	M1 for a correct expression for S_{wt} or S_{tt} (May be implied by either correct $1^{st} A1$ for $[S_{wt}] = -49$ $2^{nd} A1$ for $[S_{tt}] = awrt 74.8$ SC If both values correct but clearly mislabelled av	
(b)	2^{nd} B1ft for multiplying their S_{wt} by 1000	
(c)	M1 for a correct expression using their values provided S_{tt} and S_{ss} both > 0 for awrt – 0.801 (Correct ans. only M1A1, – 0.80 with no working M1	
(d)	B1ft for a correct comment that uses their <u>value</u> of r as support, provided 0. For $ r < 0.5$ comment must be "does <u>not</u> support", because "weak" (o.e.	.) correlation.
(e)	NB "points lie close to a straight line" is B0 unless supported by mention of their 1^{st} M1 for a correct expression for b or awrt -0.66 or -0.65 Ft their answer 2^{nd} M1 for a correct expression for a ft their value for b for a correct equation in w and t only with $a = 20$ or awrt 20.0 and $b = a$ (No fractions)	s from (a)
(f)	If their a and b are given to more than 3 sf, accept answers in (f) to 3sf or better. 1st B1 ft for correct c or "their 20.0" × 1000 2 nd B1ft for correct d or their "- 0.655" × 1000 Values can be in an s, t eq'n or c =, d = (Their a and b needn't be to 3 sf and ft their letter for t)	
(g)	B1ft for stating clearly both decrease (o.e.) and [£] 655. Ft their d and allow "inc	rease" if $d > 0$

Question Number	Scheme	Marks
2. (a)	Width $(w) = \underline{4} \operatorname{cm}$	B1
	Areas: 16 cm ² represents 32 offices (o.e.) or their $h = \frac{6}{\text{their } w} (3\text{sf}) \text{ or } \frac{8}{3.2} \times 0.6$	M1
	So height (<i>h</i>) = <u>1.5</u> cm	A1
		(3)
(b)	e.g. $(45) + \frac{20}{25} \times 5$ or $(50) - \frac{5}{25} \times 5$ (o.e.); $= (£) \underline{49}$	M1; A1
		(2)
(c)	$\frac{\sum fy}{90} = \frac{4420}{90}, \qquad = (£) \underline{49.11} \text{(or better)} (\text{Allow } \frac{442}{9} \text{ or } 49\frac{1}{9})$	M1, A1
		(2)
(d)	$\sqrt{\frac{226687.5}{90} - \bar{x}^2} = \sqrt{106.8487}$, = 10.3367 = awrt (£) <u>10.3</u>	M1, A1
(e)	Mean \approx median so distribution is symmetric (no skew or very little skew) [Allow mean > median or $k(\bar{x} - Q_2)$ ($k > 0$) so +ve skew if compatible with	B1ft (2)
	their figures] [If using quartiles we must see $Q_1 = 44.0$ and $Q_3 = 55.5$ used]	
(f)	Symmetric (or little skew) so narmal (or Dike's suggestion) may be suitable	(1) B1ft
(f)	Symmetric (or little skew) so <u>normal (or Rika's suggestion) may be suitable</u>	(1)
(g)	$\frac{c-50}{10} = 0.8416$ [N.B. use of $(1-0.8416)$ is B0]	M1, B1
	c = 58.416 = (£) 58.42 awrt 58.4	A1 (3)
	Notes	[14]
(a)	M1 for a correct calculation of areas 1 cm ² = 2 offices (o.e.)	
	A1 for $h = 1.5$ cm (Correct answer only 2/2)	
(b)	M1 for a correct expression without end point. Allow " $n + 1$ " so e.g. $(45) + \frac{2}{3}$	$\frac{0.5}{25} \times 5$
	A1 for 49 or, if $(n + 1)$ used, allow 49.1 (Correct answer of 49 only 2/2)	
(c)	M1 for an attempt at $\frac{\sum fy}{90}$ with at least 3 correct products of $\sum fy$ or $4000 \le \sum fy$	fv < 5000
	A1 for 49.11 (Allow 49.1 from correct working) (Correct answer only 2/2, 49.1	
		om, 1411110)
(d)	M1 for a correct expression including $\sqrt{\ }$, ft their mean. Allow use of s	
	A1 for awrt 10.3 Allow $s = \text{awrt } 10.4$ if clearly used. [NB use of 49.1 gives 10 (Correct answer of 10.3 with no working is 2/2)	$0.389 \Rightarrow A0$
(e)	B1ft for reason and "symmetric" (or other correct) statement [Allow positive statement and statement statement [Allow positive statement [Allow positive statement positive statement [Allow positive statement positive statement positive statement positive statement positive statement [Allow positive statement positive	_
(f)	B1ft Suggest normal is or isn't suitable with suitable reason based on (e) or n	nean and med
(g)	M1 for stand'ing using "c", 50 and 10 and setting equal to $\pm z$ value where $0.84 \le z \le 0.85$	
(5)	B1 for using $z = \pm 0.8416$ or better (calc gives 0.8416212) in standard' attempt e.g	
	A1 for awrt 58.4 (accept 3sf here) (Ans only of awrt 58.4 is M1B0A1 but 58.416	or better is 3/3)

Question Number	Scheme	Marks	
3. (a)	$p = P(B \cap C) = P(B) \times P(C) = 0.6 \times 0.25 = 0.15$	M1	
	$q = [P(C) - p] = \underline{0.10}$	A1 (2)	
(b)	$r = 1 - 0.08 - [P(B) + q] = 1 - 0.08 - 0.6 - 0.1 \text{ (o.e.) } \underline{\text{or}} \ 1 - 0.08 - (0.6 + 0.25 - p)$	M1 (2)	
	$=$ $\underline{0.22}$	A1cao (2)	
(c)	$s = [P(A) - r] = \underline{0.28}$ $t = [P(B) - p - s \text{ or use } P(B \cap C') - s = 0.6 \times 0.75 - 0.28"] = \underline{0.17}$	B1ft B1ft	
(1)		(2)	
(d)	$P(A) \times P(B) = 0.5 \times 0.6 = 0.3$ which is <u>not</u> equal to $s = 0.28$ So A and B are <u>not</u> independent	M1 A1 (2)	
(a)	$\frac{(s+p) \text{ or } (0.6-t)}{P(A \cup C) \text{ or } [P(A)+P(C)] \text{ or } (r+s+p+q)}, = \frac{("0.28"+"0.15") \text{ or } (0.6-"0.17")}{0.5+0.25}$	M1, A1ft	
(e)	$P(A \cup C) \text{ or } [P(A) + P(C)] \text{ or } (r+s+p+q)$ 0.5+0.25	WII, AIII	
	$= \frac{43}{75}$	A1 (3)	
		[11]	
	Notes		
(a)	M1 for a correct expression		
	(using independence) for $p \text{ or } 0.15$	c	
	A1 for $q = 0.10$ (both correct $2/2$)	7-1	
	0.17		
	Mark (b) & (c) together M1 for a correct expression for rusing		
(b)	P(P) (C) Can field in = [0.0.22]	0	
	$P(B \cup C)$. Can ft their $q \in [0, 0.32]$ Alcao for $r = 0.22$ (correct ans only 2/2)		
	Areas 1017 = 0.22 (correct ans only 2/2)		
(c)	Province of the Control of the Contr		
	2^{nd} B1ft for $t = 0.17$ or Fully correct Venn diagram wil	l score the	
	0.6 – their "0.15" – their "0.28" first 6 marks		
ALT	Find t then s then r If text and VD disagree use text	xt values	
(c)			
	1st B1ft for $s = 0.28 \text{ or } P(B) - "0.17" - "0.15"$		
(b)			
s=0.3	They assume A and B are independent and get $s = 0.3$ [from $P(A) \times P(B)$]		
(c)	1 st B0 for $s = 0.3$ BUT can get 2 nd B1ft for either case in the scheme		
(b)	M1 for $r = P(A) - s$ BUT then A0cao for $r = 0.2$		
(d)	M1 for a correct $P(A) \times P(B) = 0.5 \times 0.6$ or 0.3 and a clear comparison with the		
	Or calculation of $P(A / B) = \frac{7}{15}$ or 0.467 or $\frac{\text{their } s}{0.6}$ and comparison with $P(A) = 0$	0.5 (o.e.)	
	A1 dep. on M1 being earned and clear statement that A and B are <u>not</u> independent		
SC s = 0.3	dep on 1 st B1ft for $s = 0.5 - 0.2$ in (c); for correct calc. and conclusion seen (B1). On epen M0A1		
(e)	M1 for a correct ratio expression of probs: num. $<$ den. Allow $1 - (0.08 + \text{their "}t")$ on den.		
	Any sight of multiplication on the numerator e.g. 0.6×0.75 is M0		
	1st A1ft for correct ratio or ft using their values in numerator but correct denomin	nator.	
	2^{nd} A1 for $\frac{43}{75}$ or accept awrt 0.573		
L			

Question Number	Scheme	Marks
4.		
(a)	$a = \frac{1}{3}$ and $e = 1$	B1
	$c = \left[1 - \frac{5}{6}\right] = \frac{1}{6}$	B1
	$a = \frac{1}{3}$ and $e = 1$ $c = \left[1 - \frac{5}{6}\right] = \frac{1}{6}$ $"\frac{1}{3}" + 2b = \frac{5}{6}$ or $"\frac{1}{3}" + 2b + "\frac{1}{6}" = 1$	M1
	$\Rightarrow b = \frac{1}{4}$	A1
	$d = a + b = \frac{1}{3} + \frac{1}{4} $ or $d = \frac{5}{6} - \frac{1}{4} $ (o.e.) so $d = \frac{7}{12}$	B1ft
		(5)
(b)	$[P(X^2 = 1) = a + b =] \frac{7}{12}$	B1ft
		(1) [6]
	Notes	[~]
	Probabilities not in [0, 1] score 0 for corresponding A or B mark	KS
	Allow exact decimals or equivalent fractions	
(a)	In part (a) you may see answers in the tables. If answers in the table and answers on the page disagree take the answers on the page. If jumbled working is followed by a list of answers on the page mark the list. M1 for an equation for b . Follow through their value of a and possibly c if both in [0,1] Must be seen as an equation with b the only unknown. NB $b = d - a$ is not a suitable equation and use of this is M0 1st A1 for $b = \frac{1}{4}$ or 0.25 (Correct answer only is 2/2) 3rd B1ft for $d = \frac{7}{12}$ or their a + their b but their d must satisfy $\frac{1}{3} < d < \frac{5}{6}$	
(b)	B1ft for $\frac{7}{12}$ or their a + their b or their d	
	Please check the two B1ft marks carefully	

Question Number	Scheme	Marks
5. (a)	$[P(T > 20) =] P(Z > \frac{20-18}{5})$	M1
	P(Z > 0.4) = 1 - 0.6554 = <u>0.3446</u> or awrt <u>0.345</u>	M1 A1 (3)
(b)	Require $P(T > 20 T > 15)$ or $\frac{P(T > 20)}{P(T > 15)}$	M1
	$\frac{\text{"(a)"}}{P(Z > \frac{15-18}{5})} = \frac{\text{"(a)"}}{P(Z > -0.6)}, = \frac{\text{"0.3446"}}{0.7257} \text{ or } \frac{\text{"0.345"}}{0.726}$ $= 0.47485 = \text{awrt } \underline{\textbf{0.475}}$	M1, A1ft
(c)	<u></u>	(4) M1 A1ft M1
	So $\frac{d-18}{5} = 0.35$ (calculator gives 0.35085)	A1
	$d = 19.754 = \text{awrt } \underline{19.8}$ (Accept 19 mins 45(secs) or 19:45 but 19.45 is A0)	Alcso (5)
	Notes	[12]
(a)	1^{st} M1 for standardising with 20, 18 and 5. Accept \pm 2^{nd} M1 for attempting $1 - p$ [where $0.5]. Beware 1 - 0.4 (or their z va A1 for awrt 0.345 (Correct ans only 3/3)$	alue) is M0
(b)	1 st M1 for either correct conditional probability statement (allow "in words" or any letter except Z) 1 st M1 can be implied by 2 nd M1 so a mark of M0M1 should not be given. 2 nd M1 for using their (a) on num. and attempting to standardise P(T > 15) (no ±) on denom. Num.>Deno. is M0 Allow one digit transcription errors from (a) e.g. 0.3464 or 0.3466 etc for 2 nd M1 and 1 st A1ft 1 st A1ft for their 0.3446 on numerator and denominator of 0.7257 (or better: 0.7257469) provided Num < Denom. Allow 0.726 on the denominator Sight of "0.3446" 0.7257 or 0.726 will score M1M1A1ft 2 nd A1 for awrt 0.475	
(c)	1st M1 for a correct conditional probability statement that includes the 0.5 1st A1ft for $P(T > d)$ or $P(15 < T < d) = 0.5 \times$ their $P(T > 15)$ [provided $P(T > 15) > 0.5$] Follow through (3sf) their $P(T > 15) = 0.7257$ or better from part (b). (Allow 0.726) Sight of $0.5 \times$ their $0.7257 = 0.36285$ or better scores 1st M1 and 1st A1ft (Allow 0.363) 2nd M1 (dep on 1st M1) for $P(T < d) = 1 - 0.36285$ or $0.36285 + 1 - 0.36285$ in $0.36285 + $	
Beware!	$0.5 \times 0.7257 = 0.36285$ and using this (instead of 0.35) as z value leads to 19.8 b	

Question Number	Scheme	Marks
6. (a)	$[E(X)] = [0 \times \frac{1}{12}] + 3 \times \frac{2}{3} + 6 \times \frac{1}{4}$, $= \frac{7}{2}$ or <u>3.5</u>	M1, A1
		(2)
(b)	$[E(X^{2})] = \left[0^{2} \times \frac{1}{12}\right] + 3^{2} \times \frac{2}{3} + 6^{2} \times \frac{1}{4} (=15)$	M1
	$[Var(X)] = "15" - ("\frac{7}{2}")^2$	M1
	$=\frac{11}{4}$ or 2.75	A1 (2)
(c)	5p+2(1-p)=3 or [allow $p+q=1$ and $5p+2q=3$ for M1]	(3) M1A1
	So $p=\frac{1}{3}$ (*)	A1 cso
(d)	$P(Y = 2) = \frac{2}{3}$ and $P(Y = 5) = \frac{1}{3}$	(3) B1
(u)		(1)
(e)	P(S = 30) = P(X = 6 and Y = 5)	M1
	$= \frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$	A1cso (2)
	[s] 4 6 12 15 25 (30)	M1A1A1
(f)	[P(S = s)] $\frac{2}{36}$ $\frac{16}{36}$ $\frac{6}{36}$ $\frac{8}{36}$ $\frac{1}{36}$ $(\frac{3}{36})$	(3)
(g)	$E(S) = \frac{1}{36} [4 \times 2 + 6 \times 16 + 12 \times 6 + 15 \times 8 + 25 \times 1 + 30 \times 3]$	M1
	$= 11\frac{5}{12} \underline{\text{or}} \frac{137}{12} \underline{\text{or}} 11.41\dot{6}$	A1
(h)	$E(X^2) = 15$ and $E(S) = 11.416$ or $E(X^2) > E(S)$	(2) B1ft
(11)	so <u>Charlotte</u> has the higher total score	dB1ft
		[18]
(a)	Notes M1 for a fully correct expression (allow missing 0 term). Correct ans only is	2/2
(a)		
(b)	1 st M1 for a fully correct expression (allow missing 0 term) for $E(X^2)$. Allow 2 nd M1 for their $E(X^2)$ – their $E(X)^2$	var(x) label
(c)	1^{st} M1 for attempting a linear eq'n in $p(\text{or } x \text{ etc})$. Must see = 3 and have 2 terms	
	1 st A1 for a fully correct equation for p or for solving their eqns leading to cor 2^{nd} A1 for $p = \frac{1}{3}$ with M1 scored and no incorrect working seen.	rrect eqn in p
(d)	B1 for correct values for $P(Y = 2)$ and $P(Y = 5)$. Needn't be in formal table 1	out labelled.
(e)	M1 for $6 \times 5 = 30$ or $P(30) = P(6,5)$ or $P(30) = P(6) \times P(5)$ or $S = (XY = 6 \times 5)$ or $S = (XY = 6 \times 5)$	X = 6 and $Y = 5$
	Alcso dep on M1 scored for with no incorrect working seen e.g. $30 = \frac{1}{3} \times \frac{1}{4}$ is A	
(f)	1^{st} M1 for an attempt at prob. distribution with at least 3 correct (s and P(S = s))Exc' $s=30$
	1 st A1 for 6 correct s values 2 nd A1 for a fully correct prob. distribution include	
(g)	M1 for attempting $E(S)$ using their values. Must <u>see</u> 3 products (correct ft) decim	
	A1 for $11\frac{5}{12}$ or $\frac{137}{12}$ or any exact equivalent. (Correct ans. only 2/2, awrt 11.4)	only M1A0)
(h)	1^{st} B1 for correct comparison of their E(S) and E(X ²) labelled in (b) or (h) [expression of the state of the st	
	2 nd d B1 dependent on a correct comparison of their values for choosing correct	player.