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EDEXCEL INTERNATIONAL A LEVEL MATHS: QUESTIONS BY TOPIC

Sampling Methods (S3.1)

International A Level Mathematics · S3: Statistics 3 (WST03)

8 questions · 73 marks · Mark schemes included

Past papers October 2020 - June 2025 · 1 sub-topic

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HOW TO USE THIS BOOKLET

Questions are grouped by sub-topic and run from the lowest to the highest mark tariff, then oldest paper first.

Click any row below to jump straight to that sub-topic or question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme; < QUESTION brings you back.

A gold bar in the left margin marks exactly where the question sits on the original page.

Diagrams, graphs, grids and tables are printed exactly as they appear in the original papers.

Each question is filed under its main topic; longer questions may also test skills from other topics.

QUESTION	SOURCE	MARKS	PAGE
S3.1a SAMPLING METHODS		8 Qs · 73 marks	2
1. Q1	IAL S3 (WST03) June 2025	3	3
2. Q1	IAL S3 (WST03) June 2024	4	5
3. Q1	IAL S3 (WST03) January 2021	6	7
4. Q2	IAL S3 (WST03) January 2024	7	9
5. Q1	IAL S3 (WST03) (unused paper) January 2022	8	11
6. Q4	IAL S3 (WST03) January 2022	14	13
7. Q4	IAL S3 (WST03) October 2020	15	17
8. Q4	IAL S3 (WST03) June 2021	16	21



QUESTIONS

8 questions · 73 marks · 1 sub-topic

SUB-TOPIC S3.1a

SAMPLING METHODS

Sub-topic S3.1a · 8 questions · 73 marks · lowest tariff first



Question 1 continued

Lined area for writing the answer to Question 1.

(Total for Question 1 is 3 marks)



1. The names of the 400 employees of a company are listed alphabetically in a book.

The chairperson of the company wishes to select a sample of 8 employees.

The chairperson numbers the employees from 001 to 400

- (a) Describe how the list of numbers can be used to select a systematic sample of 8 employees.

(2)

- (b) State one disadvantage of systematic sampling in this case.

(1)

- (c) Write down the probability that the sample includes both the first name (employee 001) and the last name (employee 400) in the list.

(1)



Question 1 continued

Lined area for writing the answer to Question 1.

(Total for Question 1 is 4 marks)



Question 1 continued

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Handwriting practice area with horizontal lines.

(Total 6 marks)

Q1



(3)

(1)

(Total for Question 2 is / marks)



Question 1 continued

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Handwriting practice area with 25 horizontal lines.

(Total 8 marks)

Q1

Grading box for Q1.



4. A survey was carried out with students that had studied Maths, Physics and Chemistry at a college between 2016 and 2020. The students were divided into two groups *A* and *B*.

(a) Explain how a sample could be obtained from this population using quota sampling.

(2)

The students were asked which of the three subjects they enjoyed the most.
The results of the survey are shown in the table.

	Subject enjoyed the most			
	Maths	Physics	Chemistry	Total
Group <i>A</i>	16	10	13	39
Group <i>B</i>	38	13	10	61
Total	54	23	23	100

- (b) Test, at the 5% level of significance, whether the subject enjoyed the most is independent of group.

You should state your hypotheses, expected frequencies, test statistic and the critical value used for this test.

(8)

The Headteacher discovered later that the results were actually based on a random sample of 200 students but had been recorded in the table as percentages.

- (c) For the test in part (b), state with reasons the effect, if any, that this information would have on

- (i) the null and alternative hypotheses,
- (ii) the critical value,
- (iii) the value of the test statistic,
- (iv) the conclusion of the test.

(4)

Question 4 continued

Lined area for writing the answer to Question 4 continued.



Question 4 continued

Lined area for writing the answer to Question 4 continued.



(Total for Question 4 is 14 marks)



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4. Luka wants to carry out a survey of students at his school.

He obtains a list of all 280 students.

- (a) Explain how he can use this list to select a systematic sample of 40 students. (2)

Luka is trying to make his own random number table. He generates 400 digits to put in his table. Figure 1 shows the frequency of each digit in his table.

Digit generated	0	1	2	3	4	5	6	7	8	9
Frequency	36	42	33	41	44	43	48	38	32	43

Figure 1

A test is carried out at the 10% level of significance to see if the digits Luka generates follow a uniform distribution.

For this test $\sum \frac{(O-E)^2}{E} = 5.9$

- (b) Determine the conclusion of this test. (3)

The digits generated by Luka are taken two at a time to form two-digit numbers.

Figure 2 shows the frequency of two-digit numbers in his table.

Two-digit numbers generated	00–19	20–39	40–59	60–79	80–99
Frequency	31	49	30	42	48

Figure 2

- (c) Test, at the 10% level of significance, whether the two-digit numbers generated by Luka follow a uniform distribution. You should state the hypotheses, the degrees of freedom and the critical value used for this test. (8)

There are 70 students in Year 12 at his school.

- (d) State, giving a reason, the advice you would give to Luka regarding the use of his table of numbers for generating a simple random sample of 10 of the Year 12 students. (2)



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Q4

4. A college runs academic and vocational courses. The college has 1680 academic students and 2520 vocational students.

- (a) Describe how a stratified sample of 70 students at the college could be taken.

(3)

All students at the college take a basic skills test. A random sample of 50 academic students has a mean score of 57 and a variance of 60. An independent random sample of 80 vocational students has a mean score of 62 with a variance of 70

- (b) Stating your hypotheses clearly, test at the 5% level of significance, whether or not the mean basic skills score for vocational students is greater than the mean basic skills score for academic students.

(7)

- (c) Explain the importance of the Central Limit Theorem to the test in part (b).

(2)

- (d) State an assumption that is required to carry out the test in part (b).

(1)

All the academic students at the college take a basic skills course. Another random sample of 50 academic students and another independent random sample of 80 vocational students retake the basic skills test. The hypotheses used in part (b) are then tested again at the same level of significance.

The value of the test statistic z is now 1.54

- (e) Comment on the mean basic skills scores of academic and vocational students after taking this course.

(2)

- (f) Considering the outcomes of the tests in part (b) and part (e), comment on the effectiveness of the basic skills course.

(1)





(Total for Question 4 is 10 marks)



MARK SCHEMES

official mark schemes, in the same order as the questions



Question Number	Scheme		Marks
1 (a)	e.g. It reduces the potential of bias/favouritism in the selection of the players		B1
			(1)
(b)	[x =] 18		B1
			(1)
(c)	[Probability =] 0		B1
			(1)
	Notes		Total 3
(a)	B1	A correct reason referring to reducing bias or favouritism. May say e.g. “will not be selected based on ability” or “everyone has the same chance of being selected”. Condone e.g. “no bias” e.g. to make it fair Do not accept reasons relating to the benefits of taking a sample compared to a census e.g. “accurate”, “fast” but do not withhold the mark if there is a valid reason which is not contradicted by it	
(b)	B1	Cao	
(c)	B1	0 oe e.g. 0%	

Question Number	Scheme	Marks
1(a)	Select a random number as the starting point	B1
	Take every 50th employee	B1
		(2)
(b)	e.g. The alphabetical list may not be random or May be biased as list not truly random or Some combinations of names are not possible	B1
		(1)
(c)	0	B1
		(1)
Notes		Total 4
(a)	B1 for realising they need to select a random number as the starting point	
	B1 for realising they need to take every 50 th employee	
(b)	B1 for a suitable disadvantage. Sight of the words in bold or for those reasons are sufficient provided there is no contradiction or not a correct reason Condone “may not be representative”. “some employees with the same surname won’t be chosen” Do not allow any reference to requiring a sampling frame as it already has one e.g. “a sampling frame is needed because there is an alphabetical list”	
(c)	B1 0	



Question Number	Scheme	Marks
1. (a)	[In QP: 33, 15, 23] 29, 34, 39, 06, 31, 13, 42	M1A1 (2)
(b)	This will give 4 girls with numbers 15, 23, 06, 13 This will give 6 boys with numbers 33, 29, 34, 39, 31, 42	B1 B1 (2)
(c)	Since the highest number is 42 ...therefore may miss <u>older players</u>	M1 A1 (2)
[6 marks]		
Notes		
(a)	M1 for 7 numbers (at least 4 correct in any order) (Condone repeats but only count once towards the “4”) e.g. <u>29</u> , 33, <u>34</u> , <u>39</u> , 15, 29, <u>31</u> The 33 and 15 are repeats of those in QP and 29 is a repeat but all will count for the “7” This will score M1 as there are 4 of the correct numbers listed: 29, 34, 39 and 31 A1 for all 7 correct with no repeats	
(b)	1 st B1 for showing the 4 girls in sample (No ft for incorrect random numbers) 2 nd B1 for showing the 6 boys in the sample (No ft for incorrect random numbers)	
(c)	M1 for mention of highest number of 42 (or ft their highest number as long as < 60) A1 for stating that this means older players may be missing from the sample This can be awarded if their highest number is stated for M1 and is < 42	

Question Number	Scheme	Marks																																
1.	H_0 : There is no association between treatment and presence of fungus H_1 : There is association between treatment and presence of fungus	B1																																
	<table><tr><th>Expected</th><th>No treatment</th><th>Sulphur</th><th>Copper sulphate</th></tr><tr><td>No Fungus</td><td>$\frac{123 \times 30}{150}$ [=24.6]</td><td>$\frac{123 \times 63}{150}$ [=51.66]</td><td>$\frac{123 \times 57}{150}$ [=46.74]</td></tr><tr><td>Fungus</td><td>$\frac{27 \times 30}{150}$ [=5.4]</td><td>$\frac{27 \times 63}{150}$ [=11.34]</td><td>$\frac{27 \times 57}{150}$ [=10.26]</td></tr></table>	Expected	No treatment	Sulphur	Copper sulphate	No Fungus	$\frac{123 \times 30}{150}$ [=24.6]	$\frac{123 \times 63}{150}$ [=51.66]	$\frac{123 \times 57}{150}$ [=46.74]	Fungus	$\frac{27 \times 30}{150}$ [=5.4]	$\frac{27 \times 63}{150}$ [=11.34]	$\frac{27 \times 57}{150}$ [=10.26]	M1																				
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	<table><tr><th>Observed</th><th>Expected</th><th>$\frac{(O - E)^2}{E}$</th><th>$\frac{O^2}{E}$</th></tr><tr><td>20</td><td>24.6</td><td>0.86016...</td><td>16.2601...</td></tr><tr><td>55</td><td>51.66</td><td>0.21594...</td><td>58.5559...</td></tr><tr><td>48</td><td>46.74</td><td>0.03396...</td><td>49.2939...</td></tr><tr><td>10</td><td>5.4</td><td>3.91851...</td><td>18.5185...</td></tr><tr><td>8</td><td>11.34</td><td>0.98373...</td><td>5.6437...</td></tr><tr><td>9</td><td>10.26</td><td>0.15473...</td><td>7.8947...</td></tr><tr><td colspan="2">Totals:</td><td>6.167...</td><td>156.167...</td></tr></table>	Observed	Expected	$\frac{(O - E)^2}{E}$	$\frac{O^2}{E}$	20	24.6	0.86016...	16.2601...	55	51.66	0.21594...	58.5559...	48	46.74	0.03396...	49.2939...	10	5.4	3.91851...	18.5185...	8	11.34	0.98373...	5.6437...	9	10.26	0.15473...	7.8947...	Totals:		6.167...	156.167...	dM1
	Observed	Expected	$\frac{(O - E)^2}{E}$	$\frac{O^2}{E}$																														
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Totals:		6.167...	156.167...																															
$X^2 = \sum \frac{(O - E)^2}{E} \quad \text{or} \quad \sum \frac{O^2}{E} - 150$ = awrt 6.17 $\nu = (3 - 1)(2 - 1) = 2$ $\chi^2_2(0.05) = 5.991$ [Reject H_0 /significant/in the CR] There is sufficient evidence to suggest there is an association between <u>treatment</u> and presence of <u>fungus</u> .	dM1 A1 B1 B1ft A1ft																																	
Notes		[8]																																
1st B1 both hypotheses correct with treatment (oe) and fungus (oe) (treatment and fungus need to only appear in either H_0 or H_1). May be written in terms of independence. 1st M1 attempt at $\frac{\text{row total} \times \text{column total}}{\text{total}}$ (can be implied by at least one correct E_i to 1dp) 2nd M1 (dep on 1st M1) at least 2 correct terms for $\frac{(O - E)^2}{E}$ or $\frac{O^2}{E}$ or correct expressions with their E_i (allow 2sf accuracy) (May be implied by awrt 6.17 or awrt 156.17) 3rd M1 (dep on 2nd M1) for using $\sum \frac{(O - E)^2}{E}$ or $\sum \frac{O^2}{E} - 150$ (May be implied by awrt 6.17) 1st A1 awrt 6.17 2nd B1 DoF/$\nu = 2$ (May be implied by 5.991) 3rd B1ft 5.991 (or better) allow ft from their stated degrees of freedom) 2nd A1ft (dep on 3rd M1 and 3rd B1) for a correct ft contextualised conclusion. Must include “treatment” and “fungus”. Ignore any non-contextual statements. If hypotheses are the wrong way round then A0.																																		

Question Number	Scheme	Marks
2. (a)	Number all employees [1-800] Use a random number to select the first employee oe Then select every 10th employee from the list of employees	B1 B1 B1 (3)
(b)	Number all employees by city/for each city Use random numbers to select 54 employees from London, 31 employees from Edinburgh and 15 employees from Cardiff	B1 B1 B1 (3)
(c)	e.g Stratified sample reflects the population structure	B1 (1) [7]
Notes		
(a)	1 st B1 idea of numbering all employees 2 nd B1 idea of randomly selecting a starting point 3 rd B1 selecting every kth employee	
(b)	1 st B1 idea of numbering employees for each city 2 nd B1 use of random numbers (oe) 3 rd B1 54 from London, 31 from Edinburgh, 15 from Cardiff	
(c)	Any correct advantage e.g. Allows calculations [of statistics] for each city/group	



Question Number	Scheme		Marks
1 (a)	Number the 1200 students (1 – 1200)		B1
	Use a random starting point between 1 and 20		B1
	Select every 20 th person on the list		B1
			(3)
(b)(i)	They only need to generate one random number		B1
			(1)
(b)(ii)	It is not random as the list is ordered alphabetically or not all combinations of sampling units are possible		M1
	e.g. unlikely siblings would be selected		A1
			(2)
(c)	Number of Y9 students = $\frac{200}{1200} \times 60$ [= 10]		M1
	The stratified sample gives a better proportion or is more representative of		A1
			(2)
	Notes		Total 8
1 (a)	B1	numbering the students (Allow 0 – 1199).	
	B1	using a random starting point. Must be between 1 and 20 (Allow 0 – 19).	
	B1	selecting every 20 th person.	
(b)(i)	B1	a suitable comment.	
(b)(ii)	M1	a suitable comment.	
	A1	a suitable example.	
(c)	M1	a suitable calculation to find the number of Y9 students e.g. $\frac{200}{1200} \times 60$	
	A1	a correct explanation.	

Question Number	Scheme						Marks
4(a)	Non random sampling/description of non random sampling oe						B1
	from (different groups of the) population until each quota has been met						B1
							(2)
(b)	H_0 : Subject enjoyed the most and group are independent						B1
	H_1 : Subject enjoyed the most and group are not independent						
		Expected	Maths	Physics	Chemistry	Total	M1
		Group <i>A</i>	21.06	8.97	8.97	(39)	
		Group <i>B</i>	32.94	14.03	14.03	(61)	
		Total	(54)	(23)	(23)	(100)	
		Observed	Expected	$\frac{(O - E)^2}{E}$		$\frac{O^2}{E}$	dM1
		16	21.06	1.215745...		12.15575...	
		10	8.97	0.118272...		11.14827...	
		13	8.97	1.81058...		18.84058...	
		38	32.94	0.77728...		43.83728...	
		13	14.03	0.075617...		12.04562...	
		10	14.03	1.157584...		7.127584...	
		Totals		5.155...		105.155...	
		$[X^2 =] \sum \frac{(O - E)^2}{E}$ or $\sum \frac{O^2}{E} - 100$					
	= 5.155... awrt 5.16 or awrt 5.15						A1
	$\nu = (3 - 1)(2 - 1) = 2$						B1
	$\chi^2_2(0.05) = 5.991$						B1ft
	[not in CR/not significant/Do not reject H_0] There is not sufficient evidence to suggest that <u>subject</u> enjoyed and <u>group</u> are not independent						A1
							(8)
(c)(i)	No change (as the test is still the same)						B1
(ii)	No change (as $\nu = 2$ still)						B1
(iii)	Test statistics would double (= 10.310...) (as all observed and expected values are doubled.)						B1
(iv)	Conclusion is the opposite (There is sufficient evidence to suggest that subject enjoyed and group are not independent) as test statistic is now greater than the critical value (10.31 > 5.991)						B1
							(4)
	Notes						Total 14
(a)	B1	for a correct statements referring to non-random sampling or a description of a non-random method for selecting participants e.g. choosing people as they leave the school . Do not allow labelling or numbering					
	B1	for a correct statement referring to selection from different groups until quota is filled					
(b)	B1	both hypotheses correct. Must mention “Subject” and “group” at least once. (may be written in terms of association)					
	M1	Some attempt at $\frac{(\text{Row Total}) \times (\text{Column Total})}{\text{Grand Total}}$ Can be implied by at least one correct E_i to 1 dp					
	dM1	dependent on 1 st M1 for at least 2 correct terms for $\frac{(O - E)^2}{E}$ or $\frac{O^2}{E}$ or correct expressions with their E_i Accept 2 sf accuracy					

	dM1	dependent on 2 nd M1 for applying $\sum \frac{(O - E)^2}{E}$ or $\sum \frac{O^2}{E} - 100$
	A1	awrt 5.16
	SC	If no expected frequencies shown, then an answer of awrt 5.16 scores M0M0M1A1
	B1	$\nu = 2$ may be implied by a correct critical value of 5.991
	B1ft	5.991 allow ft from their stated degrees of freedom (may see 3.841, 7.815, 9.488, 11.070)
	A1	dependent on 3 rd M1 and 3 rd B1. A correct contextualised conclusion which is not rejecting H_0 . Must mention subject and group. Contradictory statements score A0 e.g. “significant, do not reject H_0 .” If no hypotheses or hypotheses wrong way round do not award.
(c)(i)	B1	a correct statement
(ii)	B1	a correct statement
(iii)	B1	a correct statement which must state that the test statistic doubles
(iv)	B1	a correct statement with correct reasoning

Question Number	Scheme	Marks																												
4. (a)	Randomly select a student from 1 to 7 oe	B1																												
	Take every 7 th student	B1																												
		(2)																												
(b)	$\nu = 10 - 1 = 9$ $\chi^2_9(10\%) = 14.684$	B1 B1ft																												
	No evidence (at 10% level of significance) that the digits generated do not follow a uniform distribution .	dB1																												
		(3)																												
(c)	H_0 : Uniform distribution is a good fit (for the two-digit numbers generated) H_1 : Uniform distribution is not a good fit (for the two-digit numbers generated)	B1																												
	<table><tr><th>O</th><th>E</th><th>$\frac{(O-E)^2}{E}$</th><th>$\frac{O^2}{E}$</th></tr><tr><td>31</td><td>40</td><td>2.025</td><td>24.025</td></tr><tr><td>49</td><td>40</td><td>2.025</td><td>60.025</td></tr><tr><td>30</td><td>40</td><td>2.5</td><td>22.5</td></tr><tr><td>42</td><td>40</td><td>0.1</td><td>44.1</td></tr><tr><td>48</td><td>40</td><td>1.6</td><td>57.6</td></tr><tr><td>200</td><td>200</td><td>8.25</td><td>208.25</td></tr></table>	O	E	$\frac{(O-E)^2}{E}$	$\frac{O^2}{E}$	31	40	2.025	24.025	49	40	2.025	60.025	30	40	2.5	22.5	42	40	0.1	44.1	48	40	1.6	57.6	200	200	8.25	208.25	B1 M1 A1
	O	E	$\frac{(O-E)^2}{E}$	$\frac{O^2}{E}$																										
	31	40	2.025	24.025																										
	49	40	2.025	60.025																										
	30	40	2.5	22.5																										
	42	40	0.1	44.1																										
	48	40	1.6	57.6																										
	200	200	8.25	208.25																										
	$\sum \frac{(O-E)^2}{E} = 8.25$ or $\sum \frac{O^2}{E} - 200 = 8.25$	A1																												
$\chi^2_4(10\%) = 7.779$	B1																													
[8.25 > 7.779] Reject H_0 / Significant	M1																													
There is evidence to suggest the two-digit numbers generated may not follow a uniform distribution .	A1																													
	(8)																													
(d)	To generate a simple random sample, Luka would need to generate two-digit numbers (from 00 to 69)	B1																												
	But Luka's table would not be suitable for generating random two-digit numbers	B1ft																												
		(2)																												
		Total 15																												
Notes																														
(a)	B1 for the idea of generating a random number to determine first student selected																													
(b)	B1 for every 7th student (not just select 40 students)																													
(b)	B1 for correct degrees of freedom (may be implied by 2 nd B1)																													
(b)	B1ft for correct critical value 14.684 or better ft their d.f. so may see $\chi^2_{10}(10\%) = 15.987$																													
(c)	B1 (dependent upon 2 nd B1) for correct conclusion in context with digits (oe) and uniform distr.																													
(c)	B1 Both hypotheses correct																													
(c)	B1 All expected values = 40																													
(c)	M1 Attempting $\frac{(O-E)^2}{E}$ or $\frac{O^2}{E}$ with at least 3 correct (1 dp truncated or rounded) or f.t. their E																													
(c)	A1 all $\frac{(O-E)^2}{E}$ or $\frac{O^2}{E}$ correct (1 dp truncated or rounded). May be implied by 8.25 or 208.25																													
(c)	A1 8.25 oe																													
(c)	B1 correct critical value 7.779 or better																													
(c)	M1 for a correct non-contextual conclusion (ignore any contradictory contextual comments for this mark) based on their cv and their test statistic																													
(c)	A1 correct conclusion in context with all previous marks scored																													
(d)	B1 for the idea of generating two-digit numbers (for a simple random sample)																													
(d)	B1ft Luka's table not suitable for generating two-digit random numbers for a simple random sample, ft parts (b) and (c)																													
SC:	If B0B0 scored, 'table only suitable for generating one-digit random numbers' scores B0B1																													

Question Number	Scheme	Notes	Marks
3.			
3(a)	$\bar{x} = \frac{1}{2}(11.52 + 13.75) = 12.635$	12.635 (may be implied by correct CI)	B1
		Use of 1.96	B1
	$\left(\frac{\sigma}{\sqrt{n}} = \frac{13.75 - 12.635}{1.96} (= 0.56887...)\right)$ $\left(\frac{\sigma}{\sqrt{n}} = \frac{13.75 - 11.52}{2 \times 1.96} (= 0.56887...)\right)$	For attempt at standard error (may be implied by awrt 0.569)	M1
		Use of 1.6449 or better (1.644853... from calc) Use of 1.64 or 1.65 is B0	B1
	$12.635 \pm 1.6449 \times 0.56887...$	For $(\text{their } \bar{x}) \pm (\text{their } 1.6449) \left(\text{their } \frac{\sigma}{\sqrt{n}} \right)$ their $\frac{\sigma}{\sqrt{n}}$ must be numerical	M1
	90% CI is (11.699..., 13.5707...)	awrt (11.7, 13.6) from correct working Correct answer with no working scores B1B1M1B0M1A1	A1
			(6)
3(b)	$4 \times 0.9^3 \times 0.1$ $= 0.2916$	$4p^3(1-p)$ (where $0 < p < 1$) awrt 0.292	M1 A1
			(2)
			Total 8

Question Number	Scheme	Notes	Marks
4. (a)	Label academic (1-1680) and vocational (1-2520)	For numbering/labelling/ordering (o.e.) students in each group	B1
	Use random numbers to select from each group.	For use of random sample/numbers/selection	B1
	28 academic and 42 vocational	Both numbers correct with the associated group	B1
			(3)
4(b)	$H_0 : \mu_v - \mu_a = 0$ $H_1 : \mu_v - \mu_a > 0$	If the hypotheses are given in terms of $\mu_a - \mu_b$, a and b must be defined.	B1
	$se = \sqrt{\frac{70}{80} + \frac{60}{50}}$	Correct attempt at se – condone slip in sample sizes.	M1
	$z = \frac{62 - 57}{\sqrt{\frac{70}{80} + \frac{60}{50}}}$	Dep on previous M1 standardising with $(62 - 57)$ and their se (Allow $\pm$)	dM1
	$z = 3.471...$ (or probability of 0.0003)	awrt ± 3.47 (or awrt 0.0003)	A1
	cv $z = 1.6449$	Allow $\pm$ but signs must be compatible Or allow comparison with probability of 0.05	B1
	Reject H_0 / significant	Dependent on 2 nd M1. A correct non-contextual statement based on their normal cv and their test statistic.	dM1
	There is evidence that the mean(o.e.) basic skills score for vocational students is greater than the mean basic skills score for academic students.	Correct comment in context. Must mention “mean”, “academic” and “vocational”. Allow f.t. on their normal cv and their test statistic.	A1f.t.
			(7)
4(c)	Mean / $\bar{X}_a$ (basic skills) score for academic students and mean / $\bar{X}_v$ (basic skills) score for vocational students...	Must mention both means.	B1
	...have (approximately) a normal distribution (as sample sizes are large.)	Must mention normal.	B1
			(2)
4(d)	Samples are (large enough) so that $s^2 = \sigma^2$	Must imply for both samples	B1
			(1)
4(e)	Test no longer significant so insufficient evidence to reject H_0	Can be implied by correct comment in context.	M1
	Insufficient evidence that mean (basic skills) score for vocational students is greater than the mean (basic skills) score for academic students/There is no longer a difference in scores /Academic students have improved their mean (basic skills) score .	Must mention scores (o.e.)	A1
			(2)
4(f)	The course was effective (o.e.)	Dep on a significant result in (b) and a non-significant result in (e)	B1
			(1)
			Total 16