

MU123

TMA 02

2019J

Covers Units 3, 4 and 5

Cut-off date 17 December 2019

Submission instructions

You will find instructions for completing TMAs in the ‘Assessment’ area of the MU123 website. Please read these instructions before beginning work on this TMA.

Reviewing your tutor’s comments on your previous TMA will help you as you work on this one.

Special instructions

Remember that you need to explain your reasoning and communicate your ideas clearly, as described in Subsection 5.3 of Unit 1. This includes:

- explaining your mathematics in the context of the question
- the correct use of notation and units
- appropriate rounding.

Your score out of 5 for good mathematical communication (GMC) will be recorded against Question 5. You do not have to submit any work for Question 5.

Question 1 – 25 marks

This question is based on your work on MU123 up to and including Unit 3.

- (a) (i) Use a factor tree to write 5544 as a product of prime factors.
Display your factor tree in your answer. [4]

- (ii) Calculate

$$\frac{5}{9} - \frac{1}{5} + \frac{13}{15},$$

leaving your answer as a fraction in its simplest form, showing all your working. [4]

- (iii) Simplify the surd

$$\frac{5\sqrt{3}}{\sqrt{15}} + \sqrt{80}$$

by writing it as a surd in its simplest form, showing your working. [3]

- (b) A group of 330 students are required to take a test. Of these, 285 actually take the test, and 45 are absent that day.

- (i) Write down the ratio of the number of students who take the test to the number of students who are absent. Simplify this as far as possible. [3]

- (ii) Of the 285 students who take the test, the numbers of students obtaining grades A, B, C and D are in the ratio 3 : 10 : 5 : 1, respectively. Calculate the number of students obtaining each grade. Explain how you could check that your answers are plausible. [4]

- (c) Novak Djokovic played in tennis matches for a total of 14 hours and 3 minutes to win the 2019 Australian Open men's singles title. He won £2.56 million in prize money.

- (i) Calculate how long Novak played (in minutes) for each pound that he won in this tournament.
Give your answer to three significant figures in both ordinary notation and scientific notation. [4]

- (ii) Calculate how much Novak won (in pounds) for each hour that he played in this tournament.
Give your answer to three significant figures in both ordinary notation and scientific notation. [3]

Question 2 – 30 marks

This question is based on your work on MU123 up to and including Unit 4.

An IT company develops software for the banking sector. It tests its code using an industry standard software package. Aiming to expand their business and be more competitive in the sector, the company has decided to pilot an inhouse software package to test its code. A company researcher wishes to compare the times taken for each package to complete tests. Both software packages were run on 15 occasions testing the same code. The times taken on each occasion are shown in Table 1.

Table 1 Comparison of detection times in minutes for the industry standard and inhouse software testing packages

Test number	Industry standard software package	Inhouse software package
1	378	315
2	321	319
3	350	320
4	398	318
5	367	328
6	387	326
7	625	338
8	354	308
9	367	347
10	378	348
11	321	338
12	350	312
13	398	337
14	367	344
15	387	325

- (a) (i) Which of the three types of investigation discussed on pages 177–9 of Unit 4 is this? Explain your answer briefly. [2]
- (ii) Are these primary or secondary data, from the researcher’s point of view? Explain your answer briefly. [2]
- (b) Before analysing these datasets on a computer, spend a few minutes scanning them by eye. Write down one feature that you observe. [1]
- (c) Open Dataplotter and create a new dataset in each column by clicking on ‘New’. Enter the data for ‘*Industry standard software package*’ in the first column and the data for ‘*Inhouse software package*’ in the second column.
- Copy and complete the following table. The means are given for you as a check that you have entered the data correctly. [8]

	Number of minutes to complete the test	
	Industry standard	Inhouse
Minimum (Min)		
Lower quartile (Q1)		
Median		
Upper quartile (Q3)		
Maximum (Max)		
Mean	383.2	328.2
Standard deviation (SD)		
Interquartile range (IQR)		
Range		
Size of dataset (n)	15	15

- (d) (i) Identify the two measures of location from the table in part (c).
Use both of these measures to determine which of the two datasets has the higher location. [3]
- (ii) Identify the three measures of spread from the table in part (c).
Which of the two datasets has the wider spread, as measured by each of these three measures? [4]
- (e) (i) The researcher concludes that the inhouse software package runs quicker than the industry standard software package. Is this a reasonable conclusion? Explain your answer briefly. [2]
- (ii) Which stage of the statistical investigation is used in part (e)(i)?
Briefly justify your answer. [2]
- (f) The researcher notices that the industry standard software package entry for the seventh test was a typing error. The correct value should have been 325. Use Dataplotter to find the revised mean and median for the industry standard software package data with the correct value for the seventh test.

Copy and complete the following table.

	Industry standard software package	
	With typing error	With correct value
Mean		
Median		
Size of dataset	15	15

What is the effect on the mean and on the median of including the typing error instead of the correct value? Explain why this happens. [4]

- (g) Would having the correct value affect the researcher's conclusion in part (e)(i)? Explain your answer briefly. [2]

Question 3 – 30 marks

This question is based on your work on MU123 up to and including Unit 5.

- (a) Simplify each of the following expressions as far as possible; multiply out any brackets, expand any algebraic fractions, and collect like terms together. Show your working.

(i) $7x - 13 - 3x + 21$ [2]

(ii) $7(5 - 3t)$ [2]

(iii) $9 + n(11 - 4n) - 11n$ [3]

(iv) $10t - 5(9s - 7t)$ [3]

(v) $5p(7 + 2p^2) - 7(3p - 6 + 2p^3)$ [5]

(vi) $\frac{3x^2 + 12x - 24}{3x}$ [4]

- (b) Solve the following equations. Show your working and check that your answers are correct.

(i) $9a - 5 = 3 + 5a$ [5]

(ii) $\frac{y}{4} - 1 = 3(y - 4)$ [6]

Question 4 – 10 marks

This question is based on your work on MU123 up to and including Unit 5.

In this question, you are asked to comment critically on a student's incorrect attempt at solving the equation

$$\frac{5}{9}(x - 7) = 10.$$

The attempt is shown below.

The equation is $\frac{5}{9}(x - 7) = 10$

Clear the fraction $5(x - 7) = 90$

Multiply out by 5 $5x - 35 = 450$

Subtract 35 $5x = 415$

Divide by 5 $x = 83$

The solution is $x = 83$

- (a) Substitute the student's solution $x = 83$ into the *left-hand side* of the equation $\frac{5}{9}(x - 7) = 10$. Explain why this shows that the student's solution is incorrect. [2]
- (b) Write out your own full and correct attempt at solving the equation and checking your solution. [4]
- (c) Identify the two lines in the student's attempt where a mistake has been made. Explain, as if directly to the student, why their working is incorrect. [4]

Question 5 – 5 marks

A score out of 5 marks for good mathematical communication over the entire TMA will be recorded under Question 5. [5]