

CAMBRIDGE TECHNICALS LEVEL 3 (2016)

Examiners' report

ENGINEERING

05822–05825, 05873

Unit 1 January 2025 series

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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from [Teach Cambridge](#).

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Unit 1 series overview

While the overall performance of candidates in this unit was about the same as in previous series, the marks were generally higher. Candidates who got high marks were generally able to get good marks in all areas of the syllabus. Those who did less well were often hampered by an inability to get marks in specific areas. In particular, calculus and exponentials and logarithms were two challenging topics. The extension of trigonometry from ratios in right-angled triangles to triangles which are not right-angled was also an area of difficulty for many candidates.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
<ul style="list-style-type: none">• were able to answer all the questions, demonstrating a complete coverage of the syllabus• were able to understand the questions and set out to answer them in a careful manner• made few errors in algebra and arithmetic.	<ul style="list-style-type: none">• were not able to answer all the questions due to insufficient knowledge• were not as careful as they needed to be to write out their answers in a careful and logical manner.

Question 1 (a)

1

(a) Multiply out $2(5x - 4y)$.

.....
.....
..... [1]

Most candidates were able to carry out this simple algebraic process without difficulty.

Question 1 (b)

(b) Multiply out, simplifying each term, $(x + 2y)^3$.

.....
.....
.....
.....
.....
..... [3]

This is one of the questions where most candidates chose to use a longer method. Those that used the binomial theorem achieved the correct, simplified, expression without difficulty. However, most candidates chose to multiply out by obtaining a quadratic multiplying two brackets and then multiplying that by the third bracket. Algebraic slips occurred often with this process.

Question 1 (e)

(e) Find the remainder when $x^3 + 2x^2 - 5x + 4$ is divided by $x - 2$.

.....

.....

.....

.....

.....

.....

..... [2]

Most candidates chose to find the remainder by long division. This created many opportunities for errors. While most seemed to be confident in what they were doing, full marks were sometimes not gained because of algebraic slips. More successful candidates employed the factor theorem; those who did so by finding $f(2)$ rarely made any arithmetic slip and obtained the remainder in one simple step.

Exemplar 1

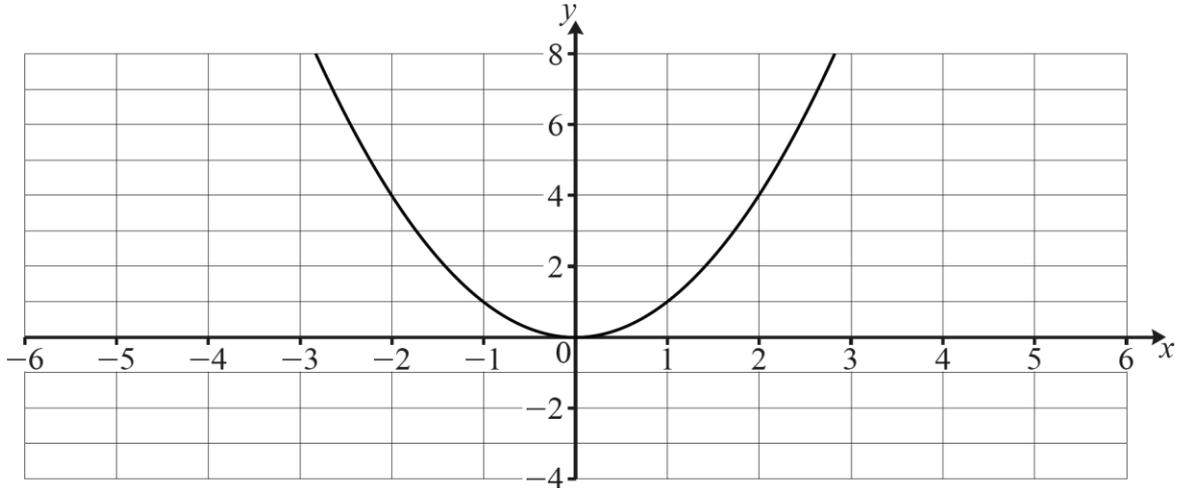
..... $(2)^3 + 2(2)^2 - 5(2) + 4 = 10$

This is all that what was necessary for Question 1 (e). Use of the factor theorem gives the answer in one line, as seen here. Most candidates, however, used a long division method which created many opportunities for error.

Question 2 (b) (i) and (ii)

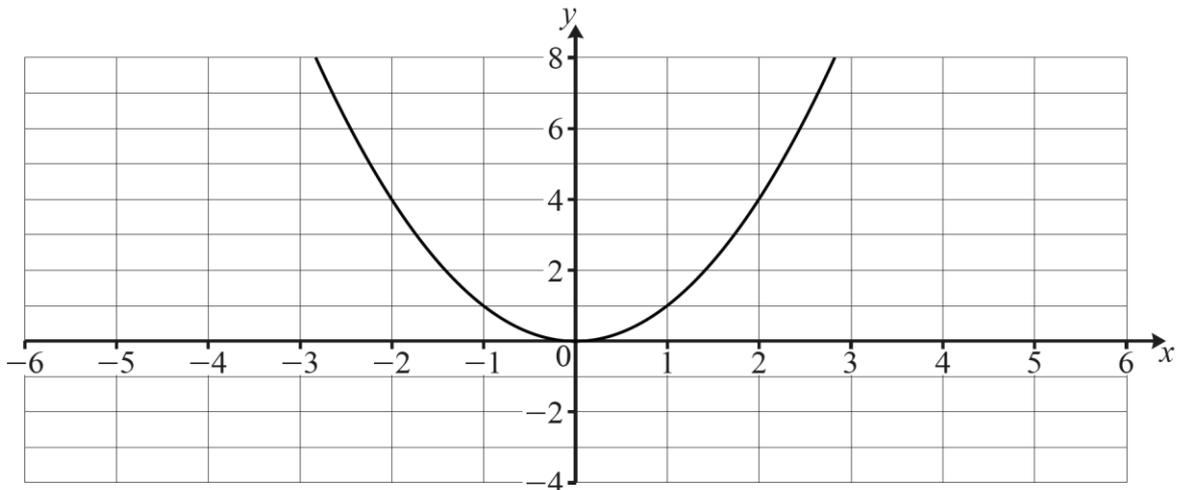
(b) Part of the curve with equation $y = x^2$ is shown on the two diagrams below.

(i) On the first diagram, sketch the curve with equation $y = (x - 2)^2$.



[2]

(ii) On the second diagram, sketch the curve with equation $y = x^2 - 2$.



[2]

The demand here was to demonstrate an understanding of translations parallel to the x-axis in Question 2 (b) (i) and parallel to the y-axis in Question 2 (b) (ii). Most candidates did not demonstrate that understanding. The fact that the equation of the original curve was provided encouraged most to do some calculations and plot. However, many produced curves that were not translations, in some cases these were not even quadratic curve.

Question 3 (a) (i) and (ii)

3

(a) Write down the exact value of:

(i) $\cos 60^\circ$

.....
..... [1]

(ii) $\sin x$ where $x = \frac{\pi}{3}$ radians.

.....
..... [1]

The first part of this question was a test on an understanding of the word 'exact'. Question 3 (a) (i) was well done, although many may have used their calculator which would give the exact answer. In Question 3 (a) (ii), however, only the most sophisticated calculators would give an exact answer meaning that most only gave a decimal approximation.

Question 3 (b)

(b) Solve the equation $\tan x = 2$ for $0^\circ < x < 360^\circ$.

.....
.....
.....
..... [2]

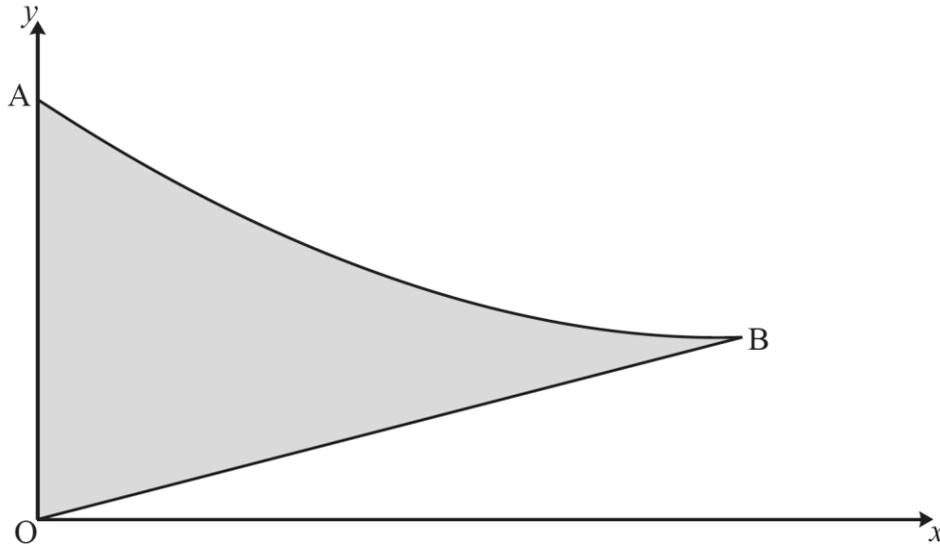
Most candidates got 1 mark for this question, with many missing the second answer in the 3rd quadrant.

Question 4 (a)

4 The shape of a component of a machine is as shown in the diagram. Units are centimetres.

Aligned to a coordinate system, the curved edge, AB, has equation $y = x^2 - 4x + 7$.

The point A lies on the y -axis and the point B is the stationary point of the curve.



(a) Write down the coordinates of A.

..... [1]

Most candidates got this mark, although some did not write the position of A in coordinates.

Question 4 (d)

(d) Determine the area of the shape.

.....

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.....

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.....

.....

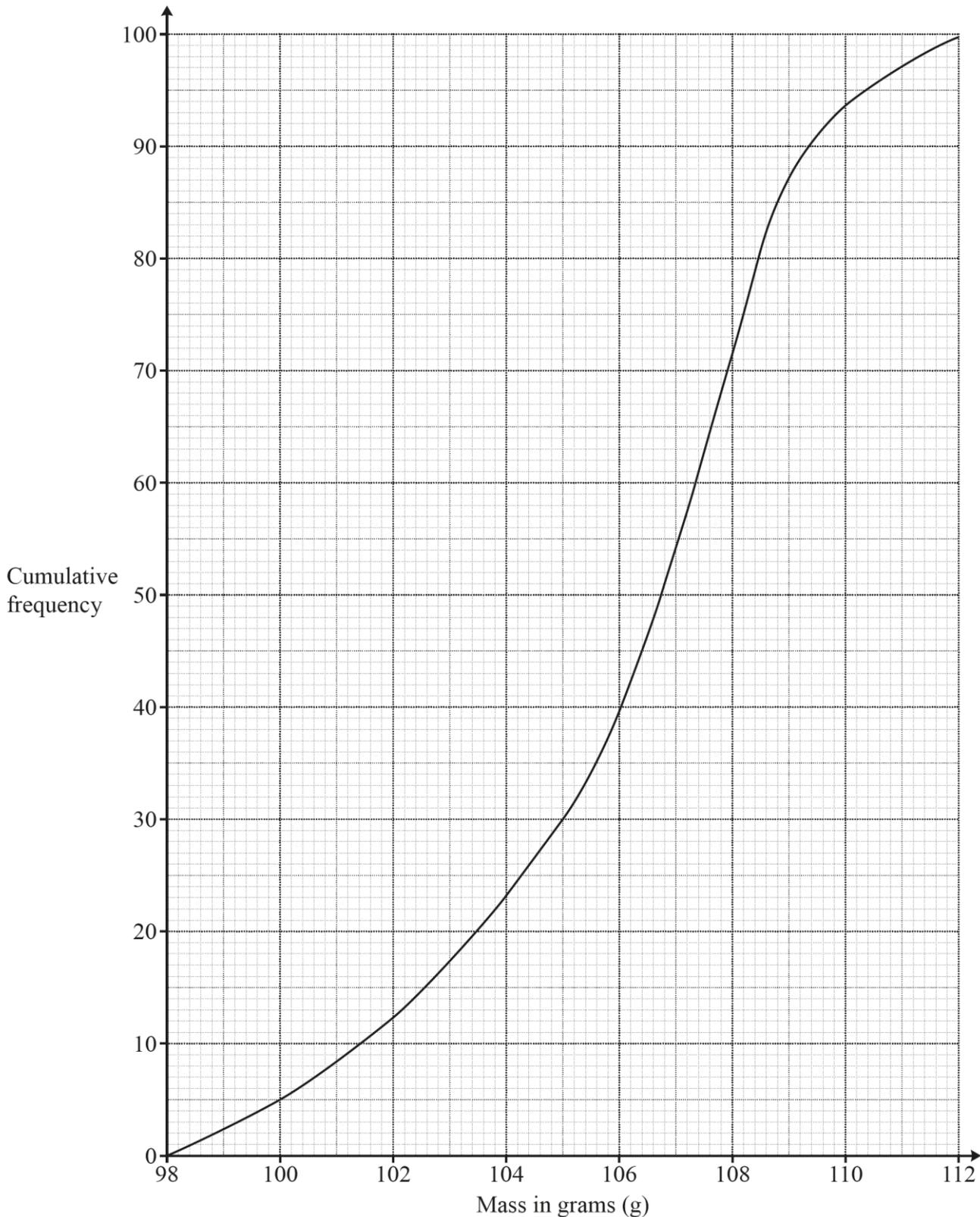
..... [6]

Some candidates had clearly used their calculator to find the appropriate area which was commendable. Many who did not obtain a correct answer by following a calculus process used the y coordinate as their upper limit instead of the x coordinate.

Question 5 (a) (i)

- 5 A machine making a particular component is required to produce components with a mass in the range 100 g to 110 g.

A control engineer selects a sample of 100 components at random from a day's production and weighs them. She records their masses to the nearest gram and draws a cumulative frequency graph as shown on the grid.



- (a) The machine is left to run providing that no more than 12% of the sample is outside the acceptable range.
- (i) On the basis of this sample, determine whether the machine should be stopped.

.....

.....

.....

.....

..... [3]

Most candidates were able to find the percentage of the sample that was outside the acceptable range and draw the correct conclusion.

Question 5 (a) (ii)

When she drew the graph, the control engineer made an error and plotted the point (109, 88) instead of (109, 80).

- (ii) Without doing any further calculation, say whether the median is affected by this error, and justify your answer.

.....

.....

.....

..... [1]

Very few candidates were able to express their thinking in this part clearly enough to demonstrate an understanding of how a median is calculated.

Question 5 (b) (i)

(b) Dev travels to work by car and on the journey he passes through three sets of traffic lights. Experience indicates that he will be stopped at a light 60% of the time, independent of the other lights.

Find the probability that:

(i) he is not stopped at the first light

.....
..... [1]

Most candidates were able to answer this question correctly.

Question 5 (b) (ii)

(ii) he is stopped at at least one light.

.....
.....
.....
.....
..... [3]

Few candidates understood that $P(\text{at least one}) = 1 - P(\text{none})$ which gave the answer quickly. Most took the long route by working out $P(1) + P(2) + P(3)$ and adding. Many of these candidates did not give the three options for $P(1)$ and $P(2)$, adding three probabilities rather than seven.

Question 6 (a)

- 6 A scientist introduces a number of a certain species of animal into an enclosed space and counts the population at the end of each year for a number of years.

He believes that the number of animals, N , at the end of year t , can be modelled by the equation $N = 100 - 90e^{-0.5t}$.

- (a) Find the number of animals that were introduced.

.....
..... [1]

The question on exponentials and logarithms is usually the most challenging question of the paper and this paper was no exception. An inability to obtain the correct answer for this part could be due to a lack of understanding of the mathematics of exponentials.

Question 6 (b)

According to this model, the population size becomes a constant number after many years.

- (b) State this number.

..... [1]

Quite a few candidates assumed that the exponential expression was for a decreasing quantity, rather than an increasing one, and gave a response that was smaller than the one given in Question 6 (a).
A common misreading of the question resulted in a response of 48 years.

Question 6 (c)

(c) Calculate the number of animals there will be after 4 years.

Give your answer to the whole number below.

.....

.....

.....

.....

..... [3]

Candidates were able to substitute $t = 4$ to obtain an answer but then did not understand the modelling process and the fact that the most appropriate response was the integer value below, as requested in the question.

Question 6 (d)

(d) After how many years will the number exceed 95?

.....

.....

.....

.....

.....

..... [3]

Rather than solve the equation with the substitution $N = 95$ (or 96) and then rounding up, many candidates used the trial and error approach. Few of those who did so, completed the trials correctly to deduce the correct answer.

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