

Mixed Functions & Relations #1

Practice Test (SAC) | CAS

Question and Answer Book

Mathbanks Practice Assessment

-
- Reading time is **5 minutes**
 - Writing time is **60 minutes**

Materials supplied

- Question and Answer Book of 15 pages
- Formula Sheet

Instructions

Students are permitted to bring into the assessment room: one approved CAS technology (calculator or software) and, if desired, one scientific calculator, and one bound reference.

Students are **not** permitted to bring mobile phones and/or any other unauthorised electronic devices into the assessment room.

Contents	pages
3 questions (39 marks)	2–15



Scan QR Code for
[Test Solutions](#)



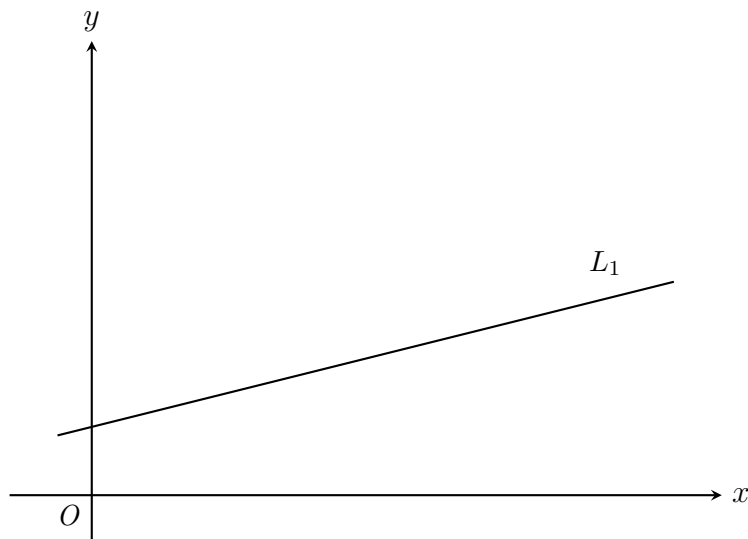
Scan QR Code for
[1000s More Exam Questions](#)

Instructions

- Answer **all** questions in the spaces provided.
 - Write your responses in English.
 - In all questions where a numerical answer is required, an **exact** value must be given unless otherwise specified.
 - In questions where more than one mark is available, appropriate working **must** be shown.
 - Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.
-

Question 1 (11 marks)

The line L_1 has equation $2y - x - 4 = 0$ and is shown in the diagram.



The point A has coordinates $(2, 3)$.

a. Show that A lies on L_1 .

1 mark

The point C has coordinates $(6, 11)$. M is the midpoint of $[AC]$.

b. Find the coordinates of M .

1 mark

c. Find the length of $[AC]$.

1 mark

The straight line L_2 is perpendicular to $[AC]$ and passes through M .

d. Show that the equation of L_2 is $2y + x - 18 = 0$.

3 marks

The point D is the intersection of L_1 and L_2 .

e. Find the coordinates of D .

2 marks

The length of $[MD]$ is $\frac{3\sqrt{5}}{2}$.

f. Write down the length of $[MD]$ correct to two decimal places.

1 mark

The point B exists such that $ABCD$ is a rhombus.

g. Find the area of $ABCD$.

2 marks

Question 2 (17 marks)

Consider the function defined by $f : \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = 6x^3 - 17x^2 + 5x$.

- a.** Find $f\left(\frac{1}{2}\right)$ and $f(3)$.

2 marks

- b.** State the factors of $f(x)$.

1 mark

A restriction is placed on the domain such that $x \in \left[\frac{1}{2}, 3\right]$.

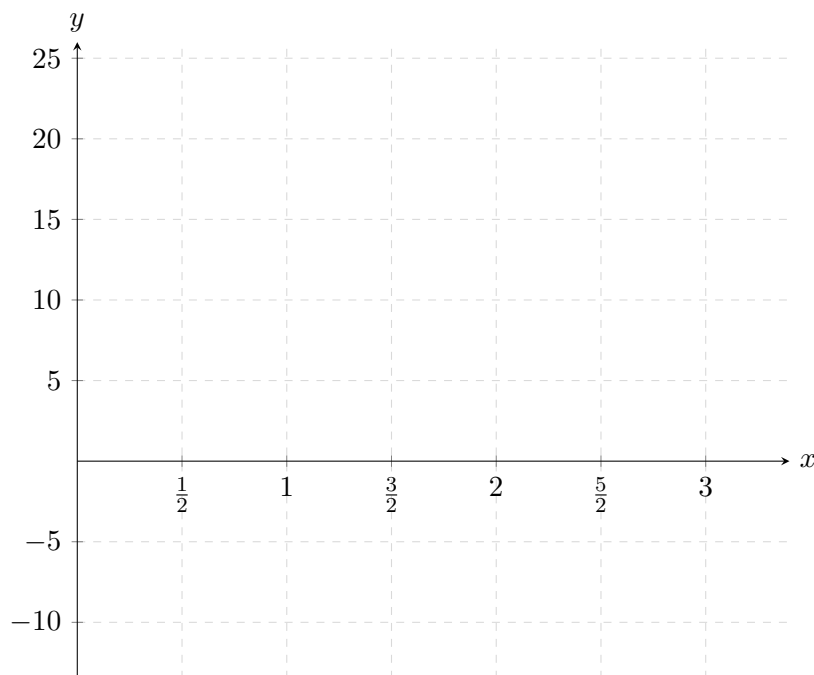
- c.** Find the minimum value of $f(x)$, correct to two decimal places.

1 mark

d. State the range of $f(x)$, correct to two decimal places.

1 mark

e. Sketch the graph of $f(x)$ on the axes below, showing the coordinates of all key points. 3 marks



f. State the x -values for which $f(x) > 1$, correct to two decimal places.

3 marks

g. Find $f'(x)$.

1 mark

h. Find $\int_{2.5}^{2.7} f(x) dx$, correct to two decimal places.

2 marks

The function $f(x)$ is a component of the hybrid function $h(x)$:

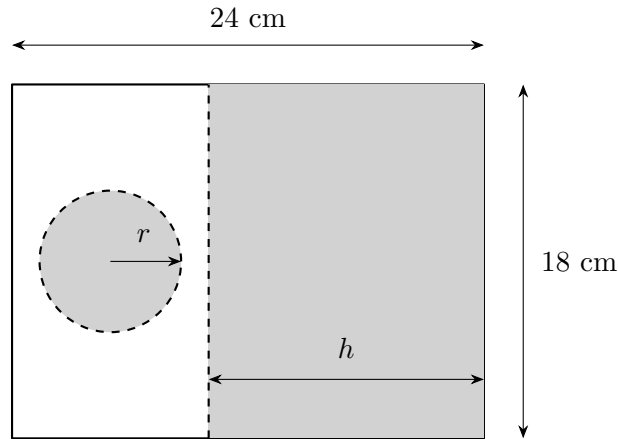
$$h(x) = \begin{cases} x + 2, & -3 < x < \frac{1}{2} \\ 6x^3 - 17x^2 + 5x, & \frac{1}{2} \leq x < 3 \\ (x - 3)^2 + 24, & x \geq 3 \end{cases}$$

i. State the value(s) of x for which $h(x)$ shows discontinuity.

2 marks

Question 3 (11 marks)

A single rectangular piece of paper, 24 cm by 18 cm, is used to construct an **open** cylinder (a curved surface and one circular base). The base circle (radius r) and the curved surface (a rectangle of width h) are cut from the paper as shown. The 18 cm side of the rectangle is rolled to form the circumference of the base.

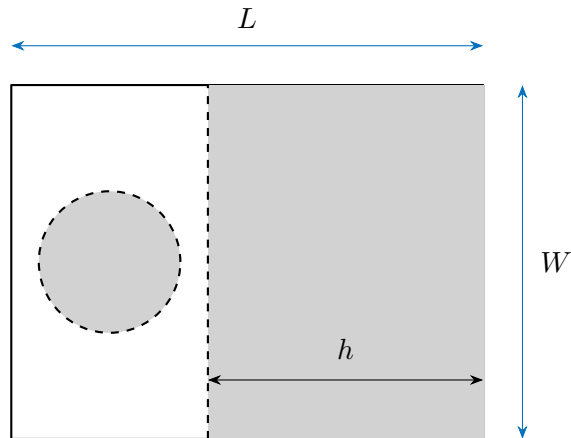


- a. Express the height h of the cylinder in terms of the radius r of the base.

1 mark

- b.** When using this outline to create the cylinder, the volume is fixed. Explain why this is the case, and find the exact volume of this design. 3 marks

Rather than using set dimensions, a new condition is used in which the **area** of the paper is fixed. The paper is still rectangular, with dimensions W and L where $L \times W = 800 \text{ cm}^2$.



- c. Determine an expression for the height of the cylinder h in terms of the radius r and the length L of the paper. 1 mark

- d. Determine an expression for the width W of the paper in terms of the radius r . 1 mark

e. Show that the volume of the cylinder is $V = 400r - 2\pi r^3$.

2 marks

f. Using calculus, determine the maximum volume of the cylinder, to the nearest cm^3 .

3 marks

Mathematical Methods Units 1 & 2 formulas

Functions and graphs

distance formula	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
midpoint formula	midpoint = $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

Straight line graphs

general equation	$y = mx + c$
equation through point (x_1, y_1)	$y - y_1 = m(x - x_1)$
gradient	$m = \frac{y_2 - y_1}{x_2 - x_1}$

Mensuration

circumference of a circle	$2\pi r$	area of a circle	πr^2
volume of a sphere	$\frac{4}{3}\pi r^3$	volume of a cylinder	$\pi r^2 h$

Calculus

$\frac{d}{dx}(x^n) = nx^{n-1}$	$\int x^n dx = \frac{1}{n+1}x^{n+1} + c, n \neq -1$
--------------------------------	---

Probability

$\Pr(A) = 1 - \Pr(A')$	$\Pr(A \cup B) = \Pr(A) + \Pr(B) - \Pr(A \cap B)$
$\Pr(A B) = \frac{\Pr(A \cap B)}{\Pr(B)}$	

About Mathbanks

Mathbanks is an online question bank for VCE Mathematics. It contains thousands of original, exam-style questions — each written with a complete worked solution and mark scheme — organised by topic and by difficulty across Mathematical Methods Units 1 & 2 and Units 3 & 4.

About This Test

This practice test brings together functions and relations from across VCE Mathematical Methods Units 1 & 2 in extended, application-based questions designed for CAS-enabled assessment. Students work with straight-line coordinate geometry — finding midpoints and lengths, deriving equations of perpendicular lines, locating points of intersection, and using these to analyse a rhombus — and with polynomial functions applied to modelling and optimisation. The test develops fluency with constructing and manipulating function rules, restricting domains, solving equations with technology, and interpreting results in context. Students verify that points lie on given lines, derive equations of straight lines, optimise the volume of an open box, and analyse a polynomial function over a restricted domain. Topics span coordinate geometry, polynomial modelling and optimisation, and applications where a relationship must be built, solved and interpreted with the aid of technology.



Scan QR Code for
Test Solutions



Scan QR Code for
1000s More Exam Questions

Test Solution Link: <https://mathbanks.com/unit-1-2/topic-tests/mixed-functions-and-relations-applications-1>
1000+ Exam Qs Questionbank: <https://mathbanks.com/unit-1-2/questionbank>