External assessment 2025

Multiple choice question book

Specialist Mathematics

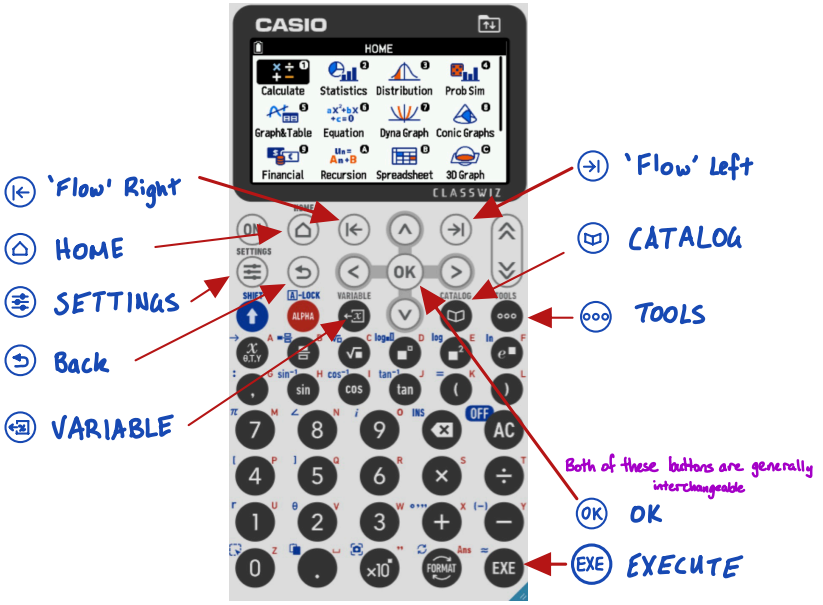
Paper 2 — Technology-active

General instruction

- Work in this book will not be marked.

Sample Solutions (unofficial)

- Suggested student response in black
  e.g. what students could write down.
- Use of CASIO *fx-1AU GRAPH* in blue.
- Notes not part of the solution in pink
  e.g. helpful hints and thoughts



Queensland Government | QCAA Queensland Curriculum & Assessment Authority

Section 1

Instruction

- Respond to these questions in the question and response book.

QUESTION 1 Calculator

Rounded to the nearest degree, an angle equivalent to the arctangent of 2 is

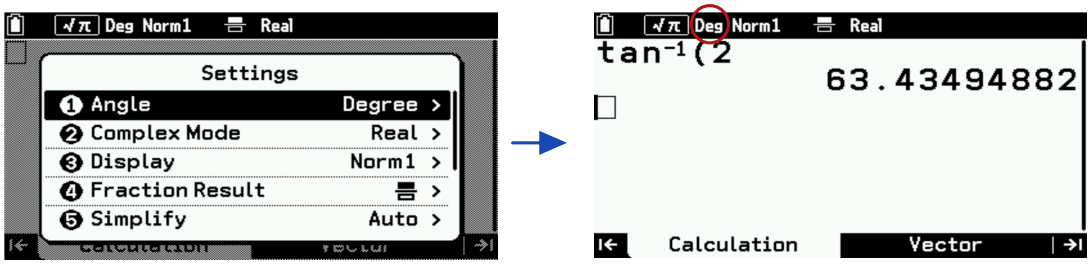
(A) 1°

(B) 2°

(C) 63°

(D) 64°

Change angle setting to degrees: ⚙, OK, ① Degree, ⮌, ⮌.



QUESTION 2 Calculator optional

Which unit vector product is correct?

(A) $\hat{i} \times \hat{i} = -1$

(B) $\hat{i} \times \hat{k} = 0$

(C) $\hat{j} \times \hat{i} = \hat{k}$

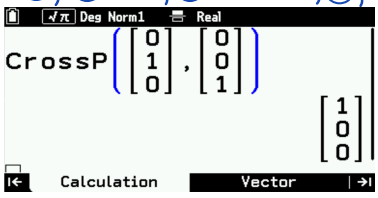
(D) $\hat{j} \times \hat{k} = \hat{i}$

A vector product (cross product) is another vector, so options (A) and (B) are incorrect.

Using the right-hand rule, the answer should be (D).

Confirm this with Cross Product.

⚙, 8 Vector, 2 Cross Product, ▶▶▶, 1 mxn, m=3 n=1, $\begin{bmatrix}0\\1\\0\end{bmatrix}$, move cursor to after the comma, ▶▶▶, 1 mxn, m=3 n=1, $\begin{bmatrix}0\\0\\1\end{bmatrix}$, EXE



Which is the unit vector $\hat{i}$

QUESTION 3 Non-Calculator

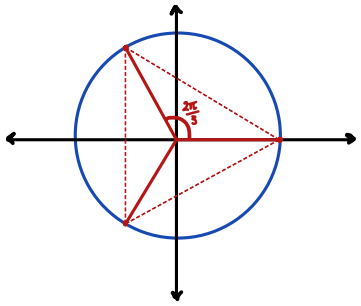
If all roots of the equation $z^3 = 1$ are plotted on an Argand plane and then joined by straight lines, the shape formed is

(A) a right-angled triangle.

(B) an equilateral triangle.

(C) an isosceles triangle.

(D) a scalene triangle.



All roots of unity form regular shapes, meaning their sides are equal in length.

QUESTION 4 Non-calculator

The expression $9\times 2^{n+1}+2^n$, where $n\in Z^+$ is divisible by

(A) 10

(B) 11

(C) 18

(D) 19

$9\times 2^{n+1}+2^n = 9\times 2^n\times 2 + 2^n$ (9×2 = 18)

$= 18\times 2^n + 2^n$

$= 2^n(18+1)$ (Factorise 2^n)

$= 2^n(19)$

QUESTION 5 Calculator

The height (cm) of people in a certain population is normally distributed with a standard deviation of 7.42 cm.

A researcher takes repeated random samples of 15 people and calculates the mean height for each sample.

The expected standard deviation (cm) of the distribution of these sample mean heights would be approximately

(A) 0.49

(B) 1.92

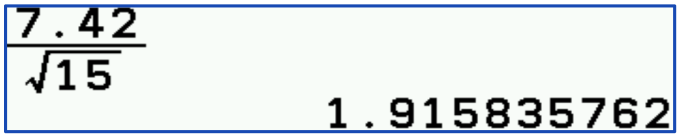
(C) 2.02

(D) 5.51

From Formula Book:

sample means	mean	μ
	standard deviation	$\frac{\sigma}{\sqrt{n}}$

Using Calculate: $\frac{7.42}{\sqrt{15}} \approx 1.9158 \approx 1.92$



QUESTION 6 Calculator

Determine the gradient of the tangent to $y^2 = 4x$ when $y = 1$.

(A) 4

(B) 2

(C) 0.5

(D) 0.25

Find x.

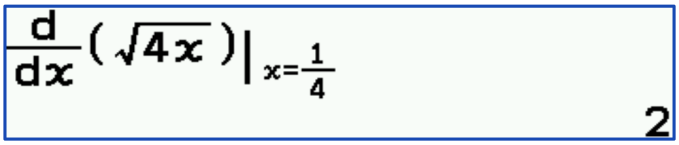
$y=1$, $1^2 = 4x$

$\frac{1}{4} = x$

Rearrange for $y = f(x)$

$y = \sqrt{4x}$

Find $\frac{dy}{dx}$ at $x=\frac{1}{4}$: ⓜ, ② Function Analysis, ② 1st Derivative, OK



Alternatively, differentiate both sides with respect to x using implicit differentiation.

$2y\cdot\frac{dy}{dx} = 4$

$\frac{dy}{dx} = \frac{4}{2y}$

$\therefore \frac{dy}{dx} = \frac{2}{y}$

When $y=1$, $\frac{dy}{dx} = \frac{2}{1} = 2$

QUESTION 7 Calculator

Given the complex number $z = \text{cis}\left(-\frac{\pi}{2}\right)$, determine $\text{Arg}(z^6)$.

(A) π

(B) 0

(C) $-\pi$

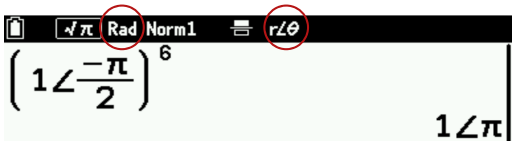
(D) -3π

Change settings to radians and polar form:

(Menu), (1) Angle, (2) Radian, (OK), (2) Complex mode, (3) $r\angle\theta$, (OK), (5).

$(1\angle -\frac{\pi}{2})^6 = 1\angle\pi$

The angle button is (SHIFT), (8)



Alternatively, use De Moivre's Theorem:

$z^6 = r^6\text{cis}(6\theta)$

$6\times -\frac{\pi}{2} = -\frac{6\pi}{2} = -3\pi$

Need principal argument: $-\pi < \theta \leq \pi$

$\therefore \text{Arg}(z) = \pi$

QUESTION 8 Non-Calculator

Consider the plane that contains both the x-axis and the y-axis. A sphere centred at (3, 4, 6) touches this plane.

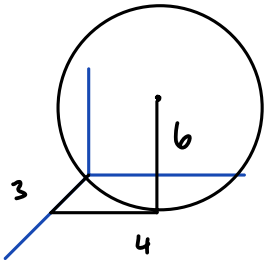
The length of the radius of the sphere is

(A) 3 units.

(B) 4 units.

(C) 5 units.

(D) 6 units.



Think about the z 'height' being 6 and that is perpendicular to the x-y plane.

You can check your work in the 3D Graph Menu.

Use a Template for Sphere:

$(x-a)^2 + (y-b)^2 + (z-c)^2 = r^2$

where $a=3$, $b=4$, $c=6$ and $r=6$.

Rotate your view and you can see the sphere touch the x-y plane.

QUESTION 9 Calculator

The masses (grams) of a random sample of 40 chocolate muffins produced by a local bakery are recorded.

Using the sample standard deviation of 0.845 grams, an approximate confidence interval for the population mean mass of chocolate muffins produced by this bakery is (149.68, 150.12) grams.

The z-value used in this calculation is

(A) 1.04

(B) 1.65

(C) 1.96

(D) 2.58

approximate margin of error	$E = z\frac{s}{\sqrt{n}}$

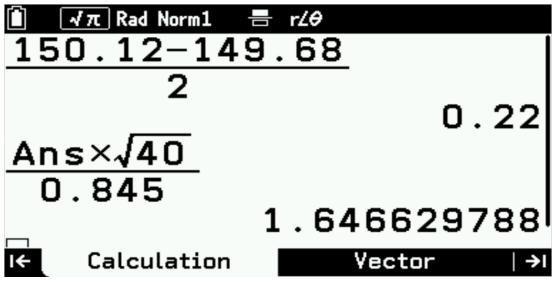
$n = 40$, $s = 0.845$

Use the calculator for the following.

$E = \frac{150.12 - 149.68}{2} = 0.22$

$\therefore 0.22 = z \times \frac{0.845}{\sqrt{40}}$

$\frac{0.22 \times \sqrt{40}}{0.845} = z \approx 1.646$

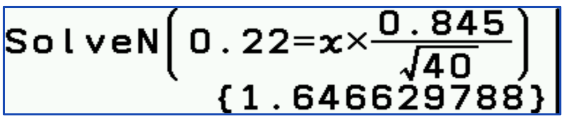


Alternatively, use the numerical equation solver:

(Menu), (2) Function Analysis, (5) SolveN, (OK)

SolveN($0.22 = x \times \frac{0.845}{\sqrt{40}}$)

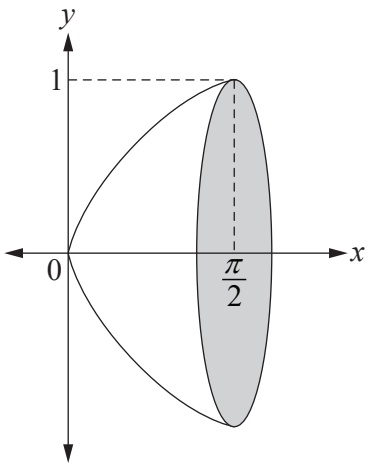
The equals button is (SHIFT), (=) (=) "open bracket"



QUESTION 10 Calculator

Consider the solid of revolution formed by rotating a section of the curve $y = \sin(x)$ around the x-axis.

Not to scale



Determine the volume of the solid of revolution.

(A) 0.79 units^3

(B) 0.86 units^3

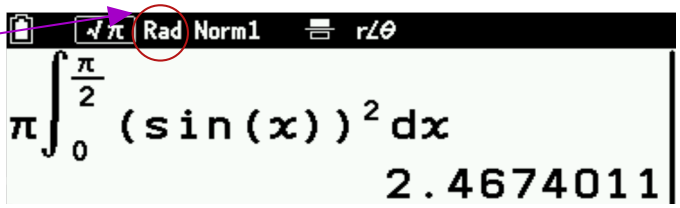
(C) 2.47 units^3

(D) 2.60 units^3

volume of a solid of revolution	about the x-axis	$V = \pi\int_a^b [f(x)]^2\,dx$
	about the y-axis	$V = \pi\int_a^b [f(y)]^2\,dy$

To integrate: ⋖, ② Function Analysis, ① Integration (∫), OK, then use arrow keys to navigate.

Common mistakes are not being in radians and forgetting the π in front.



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