Question 1

QUESTION 5

Simple Familiar
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A plane contains the origin and the points (1, 2, 3) and (3, 2, 1).

A vector normal to the plane is

(A) $\begin{pmatrix} 4 \\ -8 \\ 4 \end{pmatrix}$

(B) $\begin{pmatrix} 4 \\ -8 \\ -4 \end{pmatrix}$

(C) $\begin{pmatrix} -4 \\ -8 \\ -4 \end{pmatrix}$

(D) $\begin{pmatrix} -4 \\ -8 \\ 4 \end{pmatrix}$

Question 2

QUESTION 10

Simple Familiar
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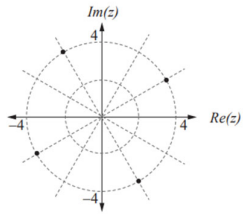
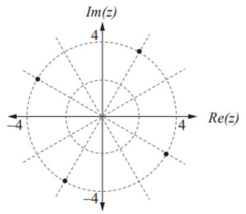
2023

The Argand diagram that represents the solutions to $z^4 = 16\,\text{cis}\left(\frac{2\pi}{3}\right)$, $z \in C$ is

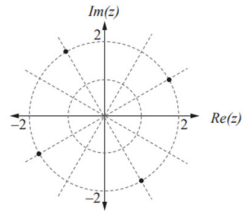
(A)



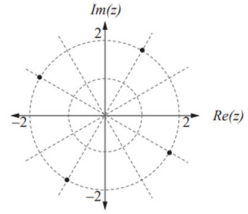
(B)



(C)



(D)



Question 3

QUESTION 11 (4 marks)

Simple Familiar
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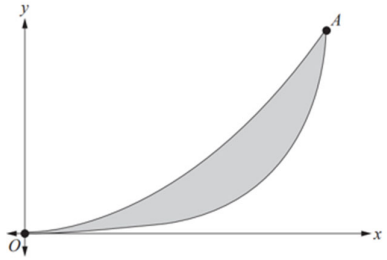
2023

The bounded region between the graphs of the functions $y = -1 + \sec\left(\frac{x}{5}\right)$ and $y = 0.1x^2$ over a certain domain is shaded as shown. The two functions intersect at the origin and point A.



a) Determine the coordinates of point A. *[1 mark]*

b) Calculate the area of the shaded region. *[1 mark]*

The shaded region is rotated about the x-axis to form a solid of revolution.

c) Determine the volume of the solid formed. *[2 marks]*

Question 4

QUESTION 18 (5 marks)

Complex Unfamiliar
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Consider the complex solutions to the following equation, where $0 < \arg(z) < \pi$.

$$(z+1)\left(z^{14} - z^{13} + z^{12} - z^{11} + \ldots + z^4 - z^3 + z^2 - z\right) = 1 - z$$

Let w_1 be the solution with the maximum possible real part and w_2 be the solution with the maximum possible imaginary part.

Show that $\frac{w_1^4}{w_2} \in Z$.