Question 1

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QUESTION 8

Given $f(x) = \tan^{-1}(2x)$, determine $f'(3)$.

(A) 0.05

(B) 0.15

(C) 2.17

(D) 3.10

Question 2

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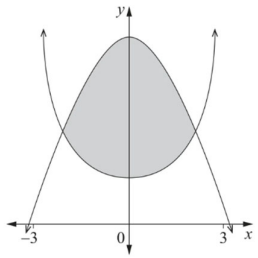
QUESTION 2

Determine the area of the shaded region between the graphs of the functions $y = \frac{1}{3}\sec\left(\frac{x}{3}\right)$ and $y = 2\cos\left(\frac{x}{2}\right)$, as shown.



Not to scale

(A) 5.29 units^2

(B) 5.51 units^2

(C) 5.65 units^2

(D) 5.71 units^2

Question 3

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QUESTION 3

Given that $2i$ is a root of $z^2 - pz - q = 0$, where $p, q \in R$, determine the values of p and q.

(A) $p = -4$ and $q = -4$

(B) $p = -4$ and $q = 4$

(C) $p = 0$ and $q = -4$

(D) $p = 0$ and $q = 4$

Question 4

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QUESTION 12 (7 marks)

Consider the complex number $z = -3 + 2i$.

a) Determine z^3 using the binomial theorem. Leave your answer in the form $a+bi$, where $a, b \in R$. *[2 marks]*

b) Convert z into the form of $r\text{cis}(\theta)$, where $-\pi < \theta \leq \pi$. *[1 mark]*

c) Use the result from Question 12b) to determine z^3 using De Moivre's theorem. Leave your answer in the form of $r\text{cis}(\theta)$, where $-\pi < \theta \leq \pi$. *[2 marks]*

d) Evaluate the reasonableness of your results from Questions 12a) and 12c), noting that the two methods to determine z^3 should produce the same result. *[2 marks]*

Question 5

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QUESTION 18 (6 marks)

Consider the polynomial $P(z) = z^3 + az^2 + bz + c$, where $a, b, c \in R$ and $z \in C$.

Two of the roots of $P(z)$ are also roots of $z^4 + z^3 + z^2 + z + 1$. The remaining root of $P(z)$ is $z = 2$.

Given $z^5 - 1 = (z-1)(z^4 + z^3 + z^2 + z + 1)$, determine a possible expression for $P(z)$.

Leave your answer in expanded form.