Revision

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AY 22/23 Trimester 2

Table of contents

Question 1 (Variant 1)

Differentiate $e^{\tan^2(x^2)}$.

Question 1 (Variant 2)

Differentiate $e^{\sec^3(x^2)}$.

Question 3 (Variant 1)

Evaluate $\lim_{x \to \pi} \dfrac{e^{\sin x} - 1}{\sqrt{x} - \sqrt{\pi}}$.

Question 3 (Variant 2)

Evaluate $\lim\limits_{x \to \frac{\pi}{2}} \dfrac{e^{4x}\sin(3x) + e^{2\pi}}{\sqrt{x} - \sqrt{\frac{\pi}{2}}}$.

Question 10 (Variant 1)

Suppose c is a positive constant. For what value of c does the graph of $y = \ln x$ and the graph of $y = cx^2$ intersect exactly once?

Question 10 (Variant 2)

Suppose c is a positive constant. For what value of c does the graph of $y = e^{4x}$ and the graph of $y = c\sqrt{x}$ intersect exactly once?

Question 1 (Variant 1)

Let $f(x) = x^4 - 6x^3 + 12x^2$. Determine an interval which f is CU.

(a) $(-\infty, 2)$ (b) $(0, 1)$ (c) $(0, \infty)$ (d) $(1, 2)$

(e) None of these

Question 1 (Variant 2)

Let $f(x) = -\cos x$. Determine an interval which f is CU.

(a) $(\frac{\pi}{2}, \pi)$ (b) $(-\frac{\pi}{2}, \frac{\pi}{2})$ (c) $(\pi, \frac{3\pi}{2})$ (d) $(-\pi, -\frac{\pi}{2})$

(e) None of these

Question 5 (Variant 1)

A rectangle has its base on the x-axis and its upper two vertices on the parabola $y = 9 - x^2$. What is the largest area the rectangle can have?

Question 5 (Variant 2)

A rectangle has its base on the x-axis and its upper two vertices on the parabola $y = 9 - x^4$. What is the largest area the rectangle can have?

Question 7 (Variant 1)

Out of the following statements, pick the one that is true.

1. If f is continuous on an interval that contains c, $f'(x) > 0$ for $x < c$ and $f'(x) < 0$ for $x > c$, then f has a local max at c.
2. If f is continuous on an interval that contains c, $f'(x) > 0$ for $x < c$ and $f'(x) < 0$ for $x > c$, then f has a local min at c.
3. If f is continuous on an interval that contains c, $f'(x) > 0$ for $x < c$ and $f'(x) > 0$ for $x > c$, then f has a local min at c.
4. If f is continuous on an interval that contains c, $f'(x) < 0$ for $x < c$ and $f'(x) < 0$ for $x > c$, then f has a local max at c.
5. None of the above.

Question 7 (Variant 2)

Assume that f is a sufficiently differentiable function on an interval that contains c. Out of the following statements, pick the one that is true.

1. If c is a local extreme point of f, then c is a critical point of f.
2. If $f'(c) = 0$, then c is an inflection point of f.
3. If the SDT is inconclusive for f at c, then c is not a local extreme point of c.
4. In every case, the FDT detects more local extreme points than the SDT.
5. None of the above.

Question 8

Find the number of inflection points of $f(x) = x^5 - \frac{5}{3}x^4$.

Question 10

Find the global maximum value of $f(x) = 2\cos x + \sin(2x)$ on $\left[0, \frac{\pi}{2}\right]$.