1) A tank has the shape of an inverted circular cone with radius 2 m and height 8 m. If water is poured into the tank at a rate of 4 m³ per minute, find the rate at which the water level is rising (in m per minute) when the water is 4 m deep.

A) $\dfrac{4}{\pi}$

B) $\dfrac{2}{\pi}$

C) $\dfrac{8}{3\pi}$

D) $\dfrac{3}{\pi}$

E) $\dfrac{4}{3\pi}$

2) Use a linear approximation to compute the approximate value of $\sqrt[3]{8.06}$.

A) 2.04

B) 2.02

C) 2.005

D) 2.01

E) 2.0025

3) If $f(x) = x^3 + x - 1$ on the interval $[0, 2]$, find a number c that satisfies the Mean Value Theorem.

A) $\dfrac{2}{\sqrt{3}}$

B) $\sqrt{2}$

C) $\sqrt{\dfrac{5}{3}}$

D) $\dfrac{\sqrt{3}}{3}$

E) $\dfrac{4}{\sqrt{3}}$

4) If m_1 is the minimum of $f(x) = x^3 + 3x^2 - 9x$ on $[0, 2]$ and m_2 is the maximum, find $m_1 + m_2$.

A) 7

B) -3

C) 5

D) 2

E) -52

5) Let $f(x) = 2x^3 - 3x^2$. f has

> A) 1 local max and 2 points of inflection
>
> B) 1 local max and 1 point of inflection
>
> C) 1 local min and 2 points of inflection
>
> D) 1 local min and 1 point of inflection
>
> E) 1 local min, 1 local max and
>   1 point of inflection

6) If $f(t) = t^2 + 4\cos t$ on $(0, 2\pi)$ find the interval(s) where the graph of f is concave upward.

> A) $\left(0, \dfrac{\pi}{6}\right) \cup \left(\dfrac{11\pi}{6}, 2\pi\right)$
>
> B) $\left(\dfrac{\pi}{3}, \dfrac{5\pi}{3}\right)$
>
> C) $\left(\dfrac{2\pi}{3}, \dfrac{4\pi}{3}\right)$
>
> D) $\left(\dfrac{\pi}{6}, \dfrac{11\pi}{6}\right)$
>
> E) $\left(0, \dfrac{\pi}{3}\right) \cup \left(\dfrac{5\pi}{3}, 2\pi\right)$

7) $\displaystyle\lim_{x\to 0} \frac{\sin x - x}{\tan x - x} =$

A) $-\dfrac{1}{2}$

B) -1

C) 0

D) $\dfrac{1}{2}$

E) 1

8) $\displaystyle\lim_{x\to 0^+} (1 - 3x)^{1/5x} =$
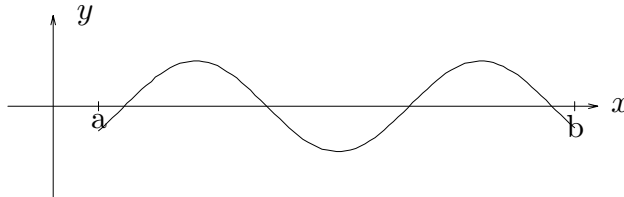
A) 1

B) e^{-15}

C) $e^{-3/5}$

D) $e^{-5/3}$

E) $e^{-1/15}$

9)   Let $f'(x) = (x+1)(x-1)^2(x-2)$. f has

A) no local maxima and 2 local minima

B) 2 local maxima and no local minima

C) 1 local maximum and 2 local minima

D) 2 local maxima and 1 local minimum

E) 1 local maximum and 1 local minimum

10) The graph of f' is given below, $a \le x \le b$.

A) f has exactly 2 points of inflection and exactly 4 local extrema.

B) f has exactly 2 points of inflection and exactly 3 local extrema.

C) f has exactly 4 points of inflection and exactly 3 local extrema.

D) f has exactly 3 points of inflection and exactly 4 local extrema.

E) f has exactly 3 points of inflection and exactly 5 local extrema.