Part 1 MCQ (30%)

Directions: Circle the letter that corresponds to the correct answer. There is only one correct answer for each question. You do not need to show your work.

(*5pts*)**Problem 1**

$$\lim_{x\to 2} \frac{x^2 - 4}{x^2 + 4} =$$

$(A)\ 1 \qquad (B)\ 0 \qquad (C)\ \frac{-1}{2} \qquad (D)\ -1 \qquad (E)\ \infty$

(*5pts*)**Problem 2**

$$\lim_{x\to 16} \frac{4 - \sqrt{x}}{x - 16} =$$

$(A)\ 0 \qquad (B)\ \frac{16}{3} \qquad (C)\ -\frac{1}{8} \qquad (D)\ \frac{-1}{16} \qquad (E)\ 1$

(*5pts*)**Problem 3**

$$\lim_{x\to 0} \frac{\sin x}{x^2 + 3x} =$$

$(A)\ 1 \qquad (B)\ \frac{1}{3} \qquad (C)\ 3 \qquad (D)\ \infty \qquad (E)\ \frac{1}{4}$

(*5pts*)**Problem 4**

If $\begin{cases} f(x) = \dfrac{x^2 - x}{2x} & \text{for } x \neq 0, \\ f(0) = k, \end{cases}$

and if f is continuous at $x = 0$, then $k =$

(A) -1 \qquad **(B)** $-\dfrac{1}{2}$ \qquad **(C)** 0 \qquad **(D)** $\dfrac{1}{2}$ \qquad **(E)** 1

($5pts$)**Problem 5**
If
$$y = 2\sqrt{x} - \frac{1}{2\sqrt{x}}$$

The $\dfrac{dy}{dx}$ is equal to

(A) $x + \dfrac{1}{x\sqrt{x}}$ (B) $x^{-1/2} + x^{-3/2}$ (C) $\dfrac{4x - 1}{4x\sqrt{x}}$

(D) $\dfrac{1}{\sqrt{x}} + \dfrac{1}{4x\sqrt{x}}$ (E) $\dfrac{4}{\sqrt{x}} + \dfrac{1}{x\sqrt{x}}$

($5pts$)**Problem 6**
If
$$y = \frac{2 - x}{3x + 1}$$

The $\dfrac{dy}{dx}$ is equal to

(A) $- \dfrac{7}{(3x + 1)^2}$ (B) $\dfrac{6x - 5}{(3x + 1)^2}$ (C) $- \dfrac{9}{(3x + 1)^2}$

(D) $\dfrac{7}{(3x + 1)^2}$ (E) $\dfrac{7 - 6x}{(3x + 1)^2}$

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Part 2 Written Questions (70%)

($15pts$)**Problem 1**

Find the equation of te tangent line to the graph $f(x) = e^x \ln x$ at $x = 1$.

(15*pts*)**Problem 2**
Find the slope of the curve
$$x^3 - xy + y^3 = 1$$
at the point $(1, 1)$.

(10*pts*)**Problem 3**

Find $\dfrac{dy}{dx}$ if

$$\sin x - \cos y - 2 = 0$$

(15*pts*)**Problem 4**

The volume of a cylinder is given by the formula $V = \pi r^2 h$ where r is the base radius and h is the height.
(a) Find the rate of change of V with respect to h if r remains constant.
(b) Find the rate of change of V with respect to r if h remains constant.
(c) Find the rate of change of h with respect to r if V remains constant.

(15*pts*)**Problem 5**

A 50ft ladder is placed against a large building. The base of the ladder is resting on an oil spill, and it slips at the rate of 3 ft. per minute. Find the rate of change of the height of the top of the ladder above the ground at the instant when the base of the ladder is 30 ft. from the base of the building.