

Name _____ DUE DATE: _____

Directions:

- Read each problem carefully and use your knowledge of calculus to determine your answer.
- In order to receive FULL CREDIT you must either SHOW ALL WORK or EXPLAIN how you got your answer!! PLEASE NOTE: A multiple choice answer alone without any work will only receive half credit.

1) $\lim_{h \rightarrow 0} \frac{\sec(\pi + h) - \sec(\pi)}{h} =$

- (A)
- -1
- (B)
- 0
- (C)
- $\frac{1}{\sqrt{2}}$
- (D)
- $\sqrt{2}$

2) The position of a particle moving along the x-axis at time t is given by $x(t) = e^{\cos(2t)}$, $0 \leq t \leq \pi$. For which of the following values of t will $x'(t) = 0$?

I. $t = 0$

II. $t = \frac{\pi}{2}$

III. $t = \pi$

- (A) I only (B) I and III only (C) I and II only (D) I, II, and III

3) The region bounded by the x-axis and the part of the graph of $y = \cos x$ between $x = -\frac{\pi}{2}$ and $x = \frac{\pi}{2}$ is separated into two regions by the line $x = k$. If the area of the region for $-\frac{\pi}{2} \leq x \leq k$ is three times the area of the region for $k \leq x \leq \frac{\pi}{2}$, then $k =$

- (A)
- $\arcsin \frac{1}{4}$
- (B)
- $\frac{\pi}{6}$
- (C)
- $\frac{\pi}{4}$
- (D)
- $\frac{\pi}{3}$

4)
$$\int \frac{18x-17}{(2x-3)(x+1)} dx =$$

- (A) $8\ln|2x-3| + 7\ln|x+1| + C$
(B) $2\ln|2x-3| + 7\ln|x+1| + C$
(C) $4\ln|2x-3| + 7\ln|x+1| + C$
(D) $7\ln|2x-3| + 2\ln|x+1| + C$

5) Use Euler's Method with $h = 0.2$ to estimate $y(1)$, if $y' = y$ and $y(0) = 1$.

- (A) 1.200 (B) 2.075 (C) 2.488 (D) 4.838

6) If c satisfies the conclusion of the Mean Value Theorem for derivatives for $f(x) = 2 \sin x$ on the interval $[0, \pi]$, then c could be

- (A) 0 (B) $\pi/4$ (C) $\pi/2$ (D) There is no value of c on $[0, \pi]$

7) The rate that an object cools is directly proportional to the difference between its temperature (in Kelvins) at that time and the surrounding temperature (in Kelvins). If an object is initially at 35K, and the surrounding temperature remains constant at 10K, it takes 5 minutes for the object to cool to 25K. How long will it take for the object to cool to 20K?

- (A) 6.66 min. (B) 7.50 min. (C) 7.52 min. (D) 8.97 min.

8) Two particles leave the origin at the same time and move along the y -axis with their respective positions determined by the functions $y_1 = \cos 2t$ and $y_2 = 4 \sin t$ for $0 < t < 6$. For how many values of t do the particles have the same acceleration?

- (A) 0 (B) 1 (C) 2 (D) 3

9) Use the trapezoid rule with $n = 4$ to approximate the area between the curve $y = x^3 - x^2$ and the x -axis from $x = 3$ to $x = 4$.

- (A) 35.266 (B) 27.766 (C) 63.031 (D) 31.516

10) The average value of $f(x) = x \ln x$ on the interval $[1, e]$ is

- (A) $\frac{e^2 + 1}{4}$ (B) $\frac{e^2 + 1}{4(e + 1)}$ (C) $\frac{e + 1}{4}$ (D) $\frac{e^2 + 1}{4(e - 1)}$

- 11) Water is draining at the rate of $48\pi\text{ft}^3/\text{sec}$ from the vertex at the bottom of a conical tank whose diameter at its base is 40 feet and whose height is 60 feet.
- Find an expression for the volume of water (in ft^3) in the tank in terms of its radius at the surface of the water.
 - At what rate (in ft/sec) is the radius of the water in the tank shrinking when the radius is 16 feet?
 - How fast (in ft/sec) is the height of the water in the tank dropping at the instant that the radius is 16 feet?
- (Volume of a cone: $\frac{1}{3}\pi r^2 h$)

12) The shaded region, R , is bounded by the graph of $y = x^2$ and the line $y = 4$, as shown in the figure above.

- Find the area of R .
- Find the volume of the solid generated by revolving R about the x -axis.
- There exists a number k , $k > 4$, such that when R is revolved about the line $y = k$, the resulting solid has the same volume as the solid in part (b). Write, but do not solve, an equation involving an integral expression that can be used to find the value of k .

