

Name:

10-digit PUID:

Lecturer:

Recitation Instructor:

Recitation Time:

Instructions:

1. This package contains 14 problems worth 7 points each.
2. Please supply all the information requested. On the scantron sheet, print your name, your division-section number, and 10 digit PUID number in addition to filling in the corresponding circles. You get two points for supplying all the information correctly.
3. Work only in the space provided, or on the backside of the pages. Circle your choice for each problem in this booklet, and mark your answer on the scantron sheet.
4. No books, notes, calculator, or any electronic devices may be used on this exam.

1.A 2.C 3.C 4.E 5.A 6.D

7.D 8.D 9.D 10.A 11.B

12.E 13.C 14.B

1. $\lim_{x \rightarrow -\infty} \frac{2x^3 - x}{3x^2 + x} =$

- A. $-\infty$
- B. $-2/3$
- C. $2/3$
- D. -1
- E. ∞

2. The intermediate value theorem guarantees that the equation $x^4 - 3x^2 + x - 1 = 0$ has a solution on the interval

- A. $(-1, 0)$
- B. $(0, 1)$
- C. $(1, 2)$
- D. $(2, 3)$
- E. Does not guarantee a solution on any of these intervals.

3. $\lim_{x \rightarrow \infty} \sqrt{x^2 + x} - \sqrt{x^2 - 3x} =$

- A. 0
- B. 1
- C. 2
- D. ∞
- E. $-\infty$

4. A particle is moving along the number line; its position at time t is

$$x(t) = \frac{3t^2 + 3t}{t^2 + 1}$$

What is its velocity when $x(t) = 3$?

- A. 0
- B. 1
- C. 2
- D. $2/3$
- E. $3/2$

5. Let $h(x) = f(x) + 2g(x)$. Given that $h'(2) = 4$ and $f'(2) = 2$, we can conclude that $g'(2) =$

- A. 1
- B. 2
- C. 3
- D. 4
- E. There is not enough information to compute $g'(2)$.

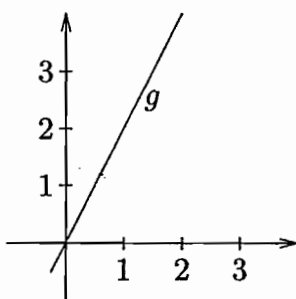
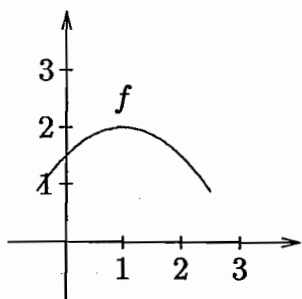
6. If $\phi(x) = 2/f(x)$, then $\phi'(x) =$

- A. $-1/f(x)$
- B. $2/f'(x)$
- C. $2f'(x)/f(x)^2$
- D. $-2f'(x)/f(x)^2$
- E. $2f(x)^2/f'(x)$

7. A conical snow-pile grows in a blizzard. At midnight, its height is 2 in and the radius of the base is 2 in. Thereafter, both the height h and radius r grow at the rate of 0.5 inches every hour. At what rate is the volume growing at 8 am? (Recall the formula $V = \pi r^2 h/3$ for the volume V .)

- A. 2π (in³/hr)
 B. 6π (in³/hr)
 C. 16π (in³/hr)
 D. 18π (in³/hr)
 E. 20π (in³/hr)

8. Below are the graphs for f and g . What is a possible value for $(f \circ g)'(1)$?



- A. 1
 B. $1/2$
 C. 2
 D. -2
 E. 0

9. Which of the lines below are parallel to the tangent line to the curve $25(x^2 - y^2) = 3(x^2 + y^2)^2$ at the point $(2,1)$?

- A. $y = 0$.
- B. $x = 0$.
- C. $y = (2/11)x - 2$.
- D. $11y + 2x = 0$.
- E. $y + 2x = 1$.

10. A car travels along a straight road going faster and faster for twenty seconds then gradually slows down for the next twenty seconds before coming to a stop. Let $d(t)$ describe its distance from the starting point. Which of the following statements are correct?

- I. For $t \in (0, 20)$, $d(t) > 0, d''(t) > 0$.
- II. For $t \in (20, 40)$, $d'(t) < 0, d''(t) < 0$.
- III. For $t > 40$, $d(t) = 0$.

- A. I only.
- B. I and II only.
- C. II only.
- D. All of them.
- E. None of them.

11. What is the derivative of $x^{\sin(x)}$ at $x = \pi/2$?

- A. Does not exist.
- B. 1.
- C. $\pi/2$.
- D. -1 .
- E. $2/\pi$.

12. Newton's law of cooling says that the temperature $T(t)$ of an object placed inside an environment of temperature 0, satisfies the differential equation

$$T'(t) = kT(t)$$

where $k < 0$. Which of the following statements are correct?

- I. $\lim_{t \rightarrow \infty} T(t) = 0$.
- II. If $T'(0) < 0$ that means the initial temperature of the object was greater than 0.
- III. If $T'(1) = 0$ then necessarily $T(0) = 0$.

- A. I and II only.
- B. II and III only.
- C. I only.
- D. II only.
- E. All of them.

13. Which of the following functions has a horizontal asymptote?

I. $1/(x^2 + 1)$.

II. $\sin(x) \cos(x)$.

III. $\tanh(x)$.

- A. I and II only.
B. II and III only.
C. I and III only.
D. None of them.
E. All of them.

14. Which of the following functions satisfy an equation of the form $f''(t) = af(t)$ for a constant $a > 0$?

I. $f(t) = \cos(kt)$ II. $f(t) = \cosh(kt)$ III. $f(t) = e^{kt}$

(Here, k is a non-zero constant.)

- A. Only I and III.
B. Only II and III.
C. Only I and II.
D. None of them.
E. All of them.