

Do not remove this answer page — you will turn in the entire exam. You have two hours to do this exam. No books or notes may be used. You may use a graphing calculator during the exam, but NO calculator with a Computer Algebra System (CAS) or a QWERTY keyboard is permitted. Absolutely no cell phone use during the exam is allowed.

The exam consists of multiple choice questions. Record your answers on this page. For each multiple choice question, you will need to fill in the box corresponding to the correct answer. For example, if (a) is correct, you must write

a  b  c  d  e

Do not circle answers on this page, but please do circle the letter of each correct response in the body of the exam. It is your responsibility to make it CLEAR which response has been chosen. You will not get credit unless the correct answer has been marked on both this page and in the body of the exam.

**GOOD LUCK!**

- |   |   |
|---|---|
| 1. <input type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input checked="" type="checkbox"/> e  | 11. <input type="checkbox"/> a <input checked="" type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e |
| 2. <input checked="" type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e  | 12. <input checked="" type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e |
| 3. <input checked="" type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e  | 13. <input checked="" type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e |
| 4. <input type="checkbox"/> a <input type="checkbox"/> b <input checked="" type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e  | 14. <input type="checkbox"/> a <input checked="" type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e |
| 5. <input type="checkbox"/> a <input type="checkbox"/> b <input checked="" type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e  | 15. <input type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input checked="" type="checkbox"/> d <input type="checkbox"/> e |
| 6. <input type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input checked="" type="checkbox"/> d <input type="checkbox"/> e  | 16. <input type="checkbox"/> a <input checked="" type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e |
| 7. <input checked="" type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e  | 17. <input type="checkbox"/> a <input checked="" type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e |
| 8. <input type="checkbox"/> a <input checked="" type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e  | 18. <input type="checkbox"/> a <input type="checkbox"/> b <input checked="" type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e |
| 9. <input type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input checked="" type="checkbox"/> d <input type="checkbox"/> e  | 19. <input type="checkbox"/> a <input type="checkbox"/> b <input checked="" type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e |
| 10. <input type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input checked="" type="checkbox"/> e | 20. <input type="checkbox"/> a <input checked="" type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e |

For grading use:

Total	
	(out of 100 pts)

---

**Formula Sheet:**

**Compound Interest:** If a principal  $P$  is invested at an interest rate  $r$  for a period of  $t$  years, then the amount  $A(t)$  of the investment is given by:

$$A(t) = P \left( 1 + \frac{r}{n} \right)^{nt} \quad (\text{if compounded } n \text{ times per year})$$

$$A(t) = P e^{rt} \quad (\text{if compounded continuously}).$$

**Change of Base Formula:** Let  $a$  and  $b$  be two positive numbers with  $a, b \neq 1$ . If  $x > 0$ , then:

$$\log_b x = \frac{\log_a x}{\log_a b}$$

---

### Multiple Choice Questions

*Show all your work on the page where the question appears.  
Clearly mark your answer both on the cover page on this exam  
and in the corresponding questions that follow.*

---

1. Let  $f(x) = 3x^2 - 1$ . Find the average rate of change of  $f(x)$  between  $x = -4$  and  $x = 5$ .

**Possibilities:**

- (a)  $-27$
  - (b)  $27$
  - (c)  $-3$
  - (d)  $\frac{1}{3}$
  - (e)  $3$
- 

2. Solve for  $x$ .

$$\log(x + 1) = 7$$

**Possibilities:**

- (a)  $x = 10^7 - 1$
  - (b)  $x = e^7 - 1$
  - (c)  $x = e^7 + 1$
  - (d)  $x = 10^6$
  - (e)  $x = 10^7 + 1$
- 

3. Determine the behavior of  $y = \frac{x}{x - 6}$  as  $x \rightarrow 6^-$ .

**Possibilities:**

- (a)  $y \rightarrow -\infty$  as  $x \rightarrow 6^-$
  - (b)  $y \rightarrow \infty$  as  $x \rightarrow 6^-$
  - (c)  $y \rightarrow 0$  as  $x \rightarrow 6^-$
  - (d)  $y \rightarrow 1$  as  $x \rightarrow 6^-$
  - (e)  $y \rightarrow \frac{1}{2}$  as  $x \rightarrow 6^-$
-

---

4. Solve.

$$4x^2 - 5x + 1 = 0$$

**Possibilities:**

(a)  $\frac{5 \pm \sqrt{41}}{8}$

(b)  $\frac{-5 \pm \sqrt{9}}{8}$

(c)  $\frac{5 \pm \sqrt{9}}{8}$

(d)  $\frac{-5 \pm \sqrt{41}}{8}$

(e)  $\frac{-5}{8} \pm \sqrt{9}$

---

5. Use a calculator to approximate  $\log_{11}(15)$ . Your answer should be correct to 5 decimal places.

**Possibilities:**

(a) 1.83346

(b) 1.36364

(c) 1.12934

(d) 0.31015

(e) 0.88547

---

6. Solve the inequality.

$$\frac{x - 1}{(x - 12)^2} > 0$$

**Possibilities:**

(a)  $(-\infty, 1) \cup (1, \infty)$

(b)  $(-\infty, 1) \cup (12, \infty)$

(c)  $(-1, 12)$

(d)  $(1, 12) \cup (12, \infty)$

(e)  $(1, 12)$

---

---

7. Let

$$f(x) = \begin{cases} 9 & \text{if } x \leq -5 \\ 18 & \text{if } -5 < x < -1 \\ 27 & \text{if } x \geq -1 \end{cases}$$

Find  $f(-4) + f(0)$ .

**Possibilities:**

- (a) 45
  - (b) 18
  - (c) 9
  - (d) 36
  - (e) 27
- 

8. Use the laws of logarithms to write the expression as a single logarithm.

$$7 \log(x) + 9 \log(x) - \log(4x - 8)$$

**Possibilities:**

- (a)  $\log(x^7 + x^9 + 4x - 8)$
  - (b)  $\log\left(\frac{x^{16}}{4x - 8}\right)$
  - (c)  $\log\left(\frac{x^{63}}{4x - 8}\right)$
  - (d)  $\log\left(\frac{x^{16}}{-4x + 8}\right)$
  - (e)  $\log\left(\frac{16x}{4x - 8}\right)$
- 

9. The graph of  $y = f(x)$  contains the point  $(6, -4)$ . What point must be on the graph of  $y = f(x + 3) + 9$ ?

**Possibilities:**

- (a)  $(3, -13)$
  - (b)  $(6, 8)$
  - (c)  $(9, 5)$
  - (d)  $(3, 5)$
  - (e)  $(9, -13)$
-

---

10. Find the domain of  $f(x) = \ln(7x + 8)$ .

**Possibilities:**

(a)  $\left[\frac{-8}{7}, \infty\right)$

(b)  $(0, \infty)$

(c)  $\left(\frac{-7}{8}, \infty\right)$

(d)  $(-\infty, \infty)$

(e)  $\left(\frac{-8}{7}, \infty\right)$

---

11. Find the remainder of the division problem.

$$\frac{x^3 + 1}{x + 6}$$

**Possibilities:**

(a)  $x^2 - 1$

(b)  $-215$

(c)  $217$

(d)  $x^2 + 1$

(e)  $-6$

---

12. Let  $f(x) = \frac{-2x + 5}{x - 3}$ . Find  $f^{-1}(-3)$ .

**Possibilities:**

(a)  $4$

(b)  $\frac{4}{5}$

(c)  $-14$

(d)  $\frac{14}{5}$

(e)  $\frac{-4}{5}$

---

---

13. Let  $r(x) = \frac{x^2 + 11}{(x - 1)(x - 5)}$ . Find the domain of  $r(x)$ .

**Possibilities:**

- (a)  $(-\infty, 1) \cup (1, 5) \cup (5, \infty)$
- (b)  $(1, 5)$
- (c)  $(-5, -1)$
- (d)  $(-\infty, \infty)$
- (e)  $(-\infty, -5) \cup (-5, -1) \cup (-1, \infty)$

---

14. Find an equation for the line with slope  $\frac{6}{7}$  that passes through the point  $(3, -16)$ .

**Possibilities:**

- (a)  $y - 16 = \frac{6}{7}(x + 3)$
- (b)  $y + 16 = \frac{6}{7}(x - 3)$
- (c)  $y - 3 = \frac{6}{7}(x + 16)$
- (d)  $y - 16 = \frac{6}{7}x + 3$
- (e)  $y + 16 = \frac{6}{7}x - 3$

---

15. Let  $r(x) = \frac{x - 7}{(x + 1)(x + 5)}$ . Find the vertical asymptote(s) of  $r(x)$ .

**Possibilities:**

- (a)  $r(x)$  does not have any vertical asymptotes.
- (b)  $x = -5$ ,  $x = -1$ , and  $x = 7$
- (c)  $x = 0$
- (d)  $x = -5$  and  $x = -1$
- (e)  $x = 7$

- 
16. Joni invests \$2000 at an interest rate of 8% per year compounded continuously. How much time will it take for the value of the investment to double? Round your answer to the nearest tenth of a year.

**Possibilities:**

- (a) 20.1 years
- (b) 8.7 years
- (c) 13.7 years
- (d) 17.3 years
- (e) 4.3 years

- 
17. Let  $f(x) = (x + 5)^2 - 7$  and  $g(x) = x - 5$ . Find  $f(g(x))$ .

**Possibilities:**

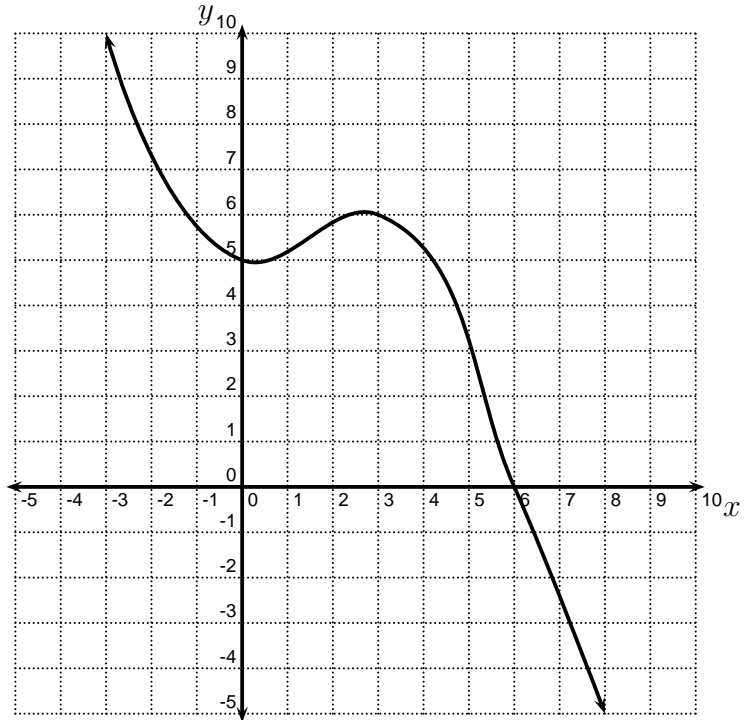
- (a)  $f(g(x)) = (x - 5)^2 - 12$
- (b)  $f(g(x)) = x^2 - 7$
- (c)  $f(g(x)) = (x - 5)^2 - 7$
- (d)  $f(g(x)) = x^2 + 10x + 18$
- (e)  $f(g(x)) = x^2 - 10x + 18$

- 
18. Suppose you want to find the intersection points of a circle of radius 5 with center  $(-1, -1)$  and a line that passes through the points  $(2, 3)$  and  $(3, 2)$ . Which of the following systems of equations must you solve?

**Possibilities:**

- (a)  $\begin{cases} (x - 1)^2 + (y - 1)^2 = 25 \\ x + y = 5 \end{cases}$
- (b)  $\begin{cases} (x + 1)^2 + (y + 1)^2 = 5 \\ x + y = -4 \end{cases}$
- (c)  $\begin{cases} (x + 1)^2 + (y + 1)^2 = 25 \\ x + y = 5 \end{cases}$
- (d)  $\begin{cases} (x - 1)^2 + (y - 1)^2 = 25 \\ x + y = -4 \end{cases}$
- (e)  $\begin{cases} (x + 1)^2 + (y + 1)^2 = 5 \\ x + y = 5 \end{cases}$

- 
19.  $P(x)$  is a polynomial. The graph of  $y = P(x)$  is shown below. Use the graph to find the factors of  $P(x)$ .



**Possibilities:**

- (a) Only  $x - 5$
  - (b) Both  $x - 6$  and  $x - 5$
  - (c) Only  $x - 6$
  - (d) Only  $x + 5$
  - (e) Only  $x + 6$
- 
20. A ball is thrown across a baseball field. Its path is given by  $y = -0.005x^2 + 1x + 8$ , where  $x$  is the horizontal distance the ball has traveled, and  $y$  is the height above ground measured in feet. What is the maximum height attained by the ball?

**Possibilities:**

- (a) 42 ft
  - (b) 58 ft
  - (c) 84 ft
  - (d) 100 ft
  - (e) 116 ft
-