

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 (c) 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!

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| 6. <input type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e | 16. <input type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e |
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| 10. <input type="checkbox"/> a <input type="checkbox"/> b <input type="checkbox"/> c <input type="checkbox"/> d <input type="checkbox"/> e | 20. <input type="checkbox"/> a <input 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. The line $x = -3$ is a vertical asymptote of $y = \frac{x-1}{x+3}$. Determine the behavior of the graph near this asymptote.

Possibilities:

- (a) $y \rightarrow \infty$ as $x \rightarrow -3^-$ and $y \rightarrow -\infty$ as $x \rightarrow -3^+$.
 - (b) $y \rightarrow 1$ as $x \rightarrow -3^-$ and $y \rightarrow 0$ as $x \rightarrow -3^+$.
 - (c) $y \rightarrow -\infty$ as $x \rightarrow -3^-$ and $y \rightarrow -\infty$ as $x \rightarrow -3^+$.
 - (d) $y \rightarrow -\infty$ as $x \rightarrow -3^-$ and $y \rightarrow \infty$ as $x \rightarrow -3^+$.
 - (e) $y \rightarrow 1$ as $x \rightarrow -3^+$ and $y \rightarrow 1$ as $x \rightarrow -3^-$.
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2. Let $r(x) = \frac{x-3}{x-4}$. Find the horizontal asymptote of $r(x)$.

Possibilities:

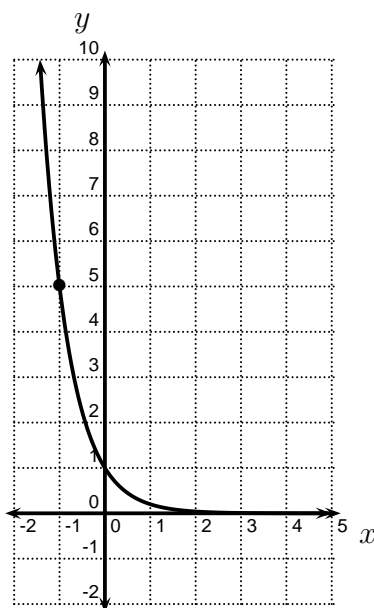
- (a) $y = \frac{3}{4}$
 - (b) $r(x)$ does not have any horizontal asymptotes.
 - (c) $y = 0$
 - (d) $y = \frac{4}{3}$
 - (e) $y = 1$
-

3. Carol invests \$5000 at an interest rate of 5% per year compounded weekly. Find the amount of the investment at the end of 16 years. Round your answer to the nearest cent. (**HINT:** There are 52 weeks in one year.)

Possibilities:

- (a) \$5077.48
 - (b) \$63214.04
 - (c) \$5256.23
 - (d) \$11198.79
 - (e) \$11123.43
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4. The graph of an exponential function, $f(x) = a^x$ is shown below. Find a .



Possibilities:

- (a) 4
- (b) 5
- (c) $\frac{1}{6}$
- (d) 6
- (e) $\frac{1}{5}$

5. Which of the following are increasing on $(-\infty, \infty)$?

(I) $y = -e^x$

(II) $y = e^{-x}$

(III) $y = e^x$

Possibilities:

- (a) Only **(I)**.
- (b) Only **(II)** and **(III)**.
- (c) Only **(II)**.
- (d) Only **(I)** and **(II)**.
- (e) Only **(III)**.

6. Express the equation in logarithmic form.

$$6^4 = 1296$$

Possibilities:

- (a) $\log_4 1296 = 6$
- (b) $\log_4 6 = 1296$
- (c) $\log_6 4 = 1296$
- (d) $\log_{1296} 4 = 6$
- (e) $\log_6 1296 = 4$

7. Which of the following statements are true?

(I) $\log(a + b) = \log(a) + \log(b)$ for all positive a and b .

(II) $\log(a^b) = b \log(a)$ for all positive a and b .

(III) $\log\left(\frac{1}{10^a}\right) = -a$ for all positive a .

Possibilities:

- (a) Only (I) and (III) are true.
- (b) Only (II) is true.
- (c) Only (II) and (III) are true.
- (d) Only (I) is true.
- (e) None of the statements are true.

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

Possibilities:

- (a) 1.04139
- (b) 1.40167
- (c) 0.88547
- (d) 2.70805
- (e) 0.73333

9. Solve for x .

$$5 \log(x + 9) = 15$$

Possibilities:

- (a) $x = \frac{10^{15} - 9}{5}$
- (b) $x = \frac{10^{15}}{5} - 9$
- (c) $x = \frac{15}{5 \log(9)}$
- (d) $x = 10^3 - 9$
- (e) $x = \frac{15}{5 - \log(9)}$

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10. Joni invests \$4000 in an account in which the interest is compounded continuously. After 10 years, the account contains \$12000. What is the interest rate on the account? Round your answer to the nearest tenth of a percent.

Possibilities:

- (a) 16.1 %
- (b) 11.0 %
- (c) 13.9 %
- (d) 17.9 %
- (e) 19.5 %

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11. The mass $m(t)$ remaining after t years from a 30-gram sample of a radioactive element is given by $m(t) = 30e^{-0.3t}$. When will the mass remaining equal 3 grams? Round your answer to the nearest hundredth of a year.

Possibilities:

- (a) About 7.68 years
- (b) About 3.33 years
- (c) About 2.30 years
- (d) About 0.13 years
- (e) About 0.12 years

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12. Let $f(x) = \ln(x - 7)$. Find the domain of $f(x)$.

Possibilities:

- (a) $(-\infty, 7]$
- (b) $[7, \infty)$
- (c) $(7, \infty)$
- (d) $(-\infty, \infty)$
- (e) $(-\infty, 7)$

13. Let $f(x) = 5x + 6$. Find the average rate of change of $f(x)$ from $x = -5$ to $x = 9$.

Possibilities:

- (a) 4
- (b) 3
- (c) 2
- (d) 6
- (e) 5

14. Find an equation for the line through the points $(2, 5)$ and $(13, 7)$.

Possibilities:

- (a) $y - 5 = \frac{2}{11}x + 13$
- (b) $y - 2 = \frac{2}{11}(x - 5)$
- (c) $y = \frac{2}{11}(x - 13) - 7$
- (d) $y + 7 = \frac{2}{11}(x + 13)$
- (e) $y - 5 = \frac{2}{11}(x - 2)$

15. Solve the inequality.

$$(x + 4)(x - 5) \leq 0$$

Possibilities:

- (a) $(-\infty, \infty)$
- (b) $(-\infty, -4] \cup [5, \infty)$
- (c) $[-4, 5]$
- (d) $(-4, 5)$
- (e) $(-\infty, -4) \cup (5, \infty)$

16. If $(-10, 4)$ lies on the graph of $f(x)$, find a point on the graph of $2f(x - 3)$.

Possibilities:

- (a) $(-7, 2)$
- (b) $(-13, 8)$
- (c) $(-13, 2)$
- (d) $(-5, 7)$
- (e) $(-7, 8)$

17. Let $f(x) = 2x^2 + 5$. Find $\frac{f(x+h) - f(x)}{h}$.

Possibilities:

- (a) $4x + 2h$
- (b) $-4x - 2h$
- (c) $\frac{2h^2 + 5}{h}$
- (d) $2h^2 + 5$
- (e) $\frac{4xh + 2h^2 + 10}{h}$

18. Find the quotient and remainder of the division problem.

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

Possibilities:

- (a) Quotient: $x + 3$
Remainder: 28
- (b) Quotient: $x + 3$
Remainder: 10
- (c) Quotient: $x^2 - 3x + 9$
Remainder: 28
- (d) Quotient: x
Remainder: -26
- (e) Quotient: $x^2 - 3x + 9$
Remainder: -26

19. Let

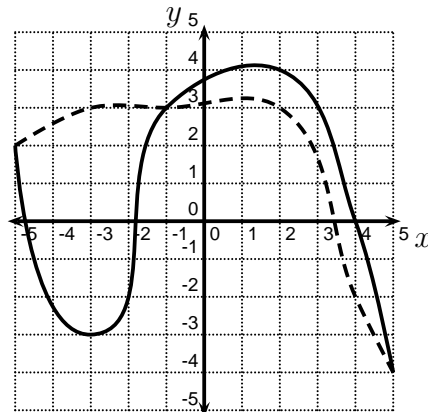
$$f(x) = \begin{cases} x + 2 & \text{if } x \leq -5 \\ x - 2 & \text{if } -5 < x < -1 \\ x^2 & \text{if } x \geq -1 \end{cases}$$

Find $f(0)$.

Possibilities:

- (a) 2
- (b) -2
- (c) 0
- (d) 2, -2 , and 0
- (e) None of the above

20. In the picture below, the graph of $y = f(x)$ is the solid graph, and the graph of $y = g(x)$ is the dashed graph. Find the true statement.



Possibilities:

- (a) $f(4) = -2$
- (b) $f(2) < g(2)$
- (c) $f(-1) > g(-1)$
- (d) $f(-3) < g(-3)$
- (e) $f(-1) = 2$