

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 and short answer 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!

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| 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)

Multiple Choice Questions

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

1. Let $f(x) = 3x^{13} + x^4 - 3x^2 + 5x + 7$. Determine the end behavior of $y = f(x)$.

Possibilities:

- (a) $y \rightarrow \infty$ as $x \rightarrow \infty$ and $y \rightarrow \infty$ as $x \rightarrow -\infty$
 - (b) $y \rightarrow -\infty$ as $x \rightarrow \infty$ and $y \rightarrow \infty$ as $x \rightarrow -\infty$
 - (c) $y \rightarrow \infty$ as $x \rightarrow \infty$ and $y \rightarrow -\infty$ as $x \rightarrow -\infty$
 - (d) $y \rightarrow -\infty$ as $x \rightarrow \infty$ and $y \rightarrow -\infty$ as $x \rightarrow -\infty$
 - (e) None of the above.
-

2. Find a formula for the parabola that has vertex $(-3, 5)$ and passes through the point $(1, -27)$.

Possibilities:

- (a) $y = -2x^2 + 12x - 23$
 - (b) $y = 2x^2 + 12x + 13$
 - (c) $y = -x^2 - 6x - 4$
 - (d) $y = -x^2 - 3x - 27$
 - (e) $y = -2x^2 - 12x - 13$
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3. Which of the following is a true statement about the function $f(x) = \frac{x-1}{x^2+9x+20}$?

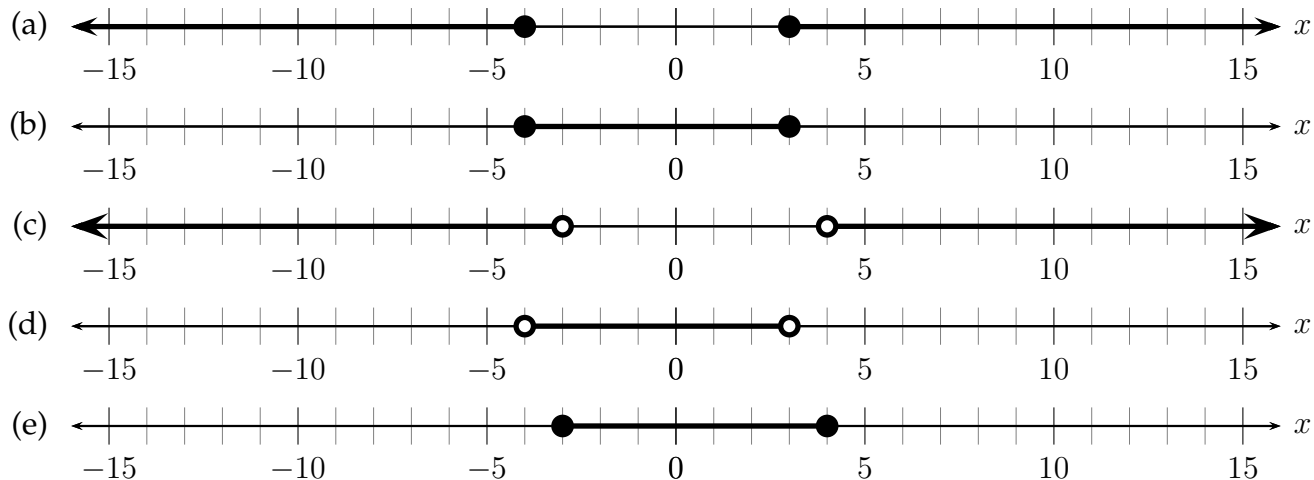
Possibilities:

- (a) The graph of $y = f(x)$ has a horizontal asymptote $y = 0$ and a y-intercept of $(0, \frac{-1}{20})$.
 - (b) The graph of $y = f(x)$ has a horizontal asymptote $y = 1$ and a y-intercept of $(0, -5)$.
 - (c) The graph of $y = f(x)$ has a horizontal asymptote $y = 0$ and a y-intercept of $(0, -5)$.
 - (d) The graph of $y = f(x)$ has a horizontal asymptote $y = 0$ and a y-intercept of $(0, 1)$.
 - (e) The graph of $y = f(x)$ has a horizontal asymptote $y = 1$ and a y-intercept of $(0, \frac{-1}{20})$.
-

4. Solve the inequality and graph the solution set on the real number line.

$$x^2 + x - 12 \leq 0$$

Possibilities:



5. Let $f(x) = 14 + 8x$. Find the average rate of change of $f(x)$ from $x = a$ to $x = a + h$. (Assume $h \neq 0$).

Possibilities:

- (a) 8
- (b) -8
- (c) $\frac{16a + 8h}{h}$
- (d) 1
- (e) $\frac{14 + 8h}{h}$

6. Let $f(x) = 9x$ and $g(x) = x + 5$. Find $f(g(x))$.

Possibilities:

- (a) $f(g(x)) = 9x$
- (b) $f(g(x)) = 9x^2 + 45x$
- (c) $f(g(x)) = 9x + 5$
- (d) $f(g(x)) = 9x^2 + 45$
- (e) $f(g(x)) = 9x + 45$

-
7. A farmer has 160 feet of fencing to construct three rectangular pens as shown in the diagram below.



What is the maximum possible area of all three pens?

Possibilities:

- (a) 20 ft^2
- (b) 800 ft^2
- (c) 1600 ft^2
- (d) 160 ft^2
- (e) 1000 ft^2

-
8. Use the Rational Root Theorem to factor $P(x) = x^4 + 3x^3 - 13x^2 - 27x + 36$ completely.

Possibilities:

- (a) $P(x) = (x - 1)(x + 3)^2(x - 4)$
 - (b) $P(x) = (x + 3)(x - 4)(x - 3)(x + 15)$
 - (c) $P(x) = (x + 1)(x - 2)(x - 3)(x + 6)$
 - (d) $P(x) = (x - 1)(x + 1)(x - 2)(x + 15)$
 - (e) $P(x) = (x - 1)(x + 3)(x + 4)(x - 3)$
-

9. Find the remainder of the division problem.

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

Possibilities:

- (a) $x^2 - 1$
- (b) 217
- (c) -215
- (d) 6
- (e) $x^2 + 1$

10. Use the graphing function on your calculator to approximate all real solutions to the equation below.

$$\log(x) = 14 - x^3$$

Possibilities:

- (a) $x \approx 2.3763$
- (b) $x \approx 0.3781$
- (c) $x \approx 1.0000$
- (d) $x \approx 2.4101$
- (e) $x \approx 2.3882$

11. Let $f(x) = |x - 3|$. Find the average rate of change of $f(x)$ between $x = 1$ and $x = 8$.

Possibilities:

- (a) $\frac{7}{3}$
- (b) $\frac{3}{7}$
- (c) 1
- (d) 3
- (e) $\frac{-3}{7}$

12. Find an equation for the line through the points (5, 2) and (11, 9).

Possibilities:

(a) $y - 2 = \frac{7}{6}(x - 5)$

(b) $y + 9 = \frac{7}{6}(x + 11)$

(c) $y - 2 = \frac{6}{7}x + 11$

(d) $y - 5 = \frac{7}{6}(x - 2)$

(e) $y = \frac{-6}{7}(x - 11) - 9$

13. Let $f(x) = \sqrt[3]{x - 5}$. Find $f^{-1}(x)$.

Possibilities:

(a) $f^{-1}(x) = (x + 5)^3$

(b) $f^{-1}(x) = x^3 + 5$

(c) $f^{-1}(x) = \frac{5}{3}$

(d) $f^{-1}(x) = 3x - 15$

(e) $f(x)$ is not one-to-one, therefore it does not have an inverse.

14. Solve for x .

$$\log_4(x + 4) = 2$$

Possibilities:

(a) 4

(b) 20

(c) -3.5

(d) 12

(e) 18

15. Solve the equation for b .

$$A = \frac{1}{2}bh.$$

Possibilities:

(a) $2 + Ah$

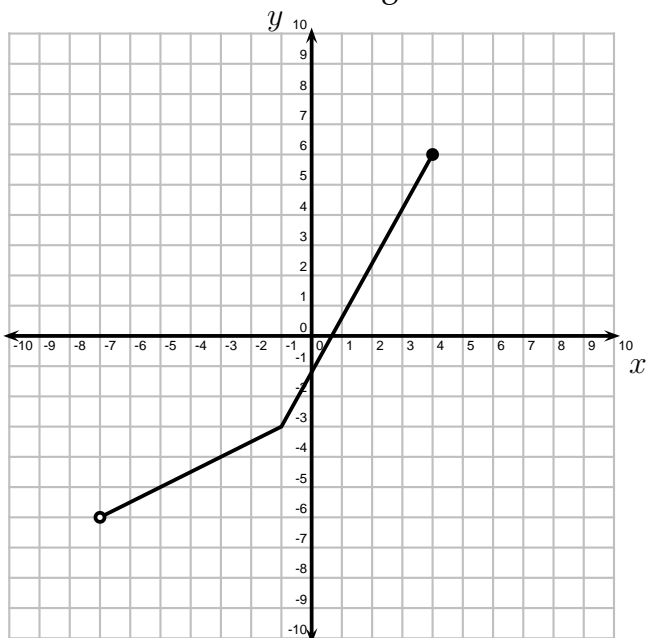
(b) $2A - h$

(c) $\frac{A}{2h}$

(d) $\frac{2A}{h}$

(e) $\sqrt{A} - h$

16. The graph of the one-to-one function f is shown below. Find the range of f^{-1} .



Possibilities:

(a) $[-6, 6)$

(b) $[-7, 4)$

(c) $(-7, 4]$

(d) $(-6, 6]$

(e) $[-7, -1) \cup (-1, 4)$

17. Solve.

$$2x^2 - 6x + 1 = 0$$

Possibilities:

- (a) $\frac{-6}{4} \pm \sqrt{28}$
 - (b) $\frac{6 \pm \sqrt{44}}{4}$
 - (c) $\frac{-6 \pm \sqrt{28}}{4}$
 - (d) $\frac{-6 \pm \sqrt{44}}{4}$
 - (e) $\frac{6 \pm \sqrt{28}}{4}$
-

18. Suppose that you transform the graph of $y = x^2$ by shifting the graph left 5 units then scaling vertically by a factor of 2. Find an equation for the new graph.

Possibilities:

- (a) $y = 5(x + 2)^2$
 - (b) $y = (2x)^2 + 5$
 - (c) $y = 2(x + 5)^2$
 - (d) $y = \frac{(x - 5)^2}{2}$
 - (e) $y = (2x + 5)^2$
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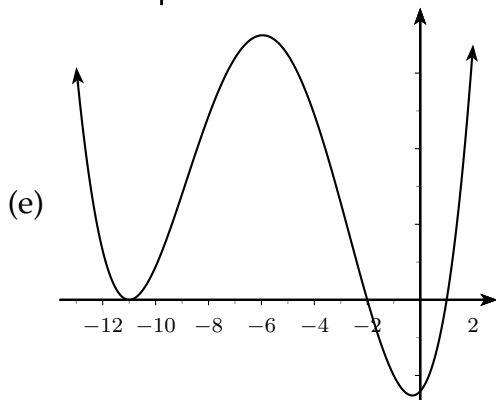
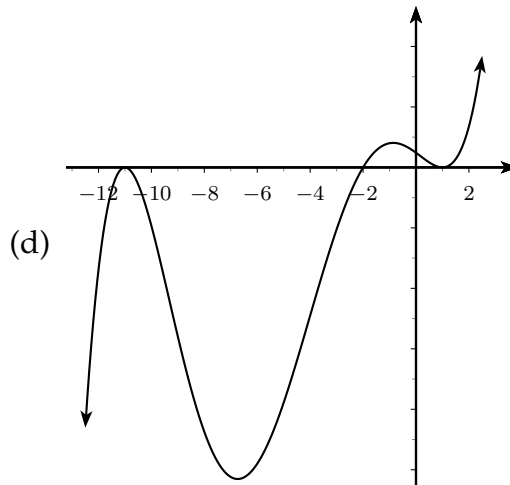
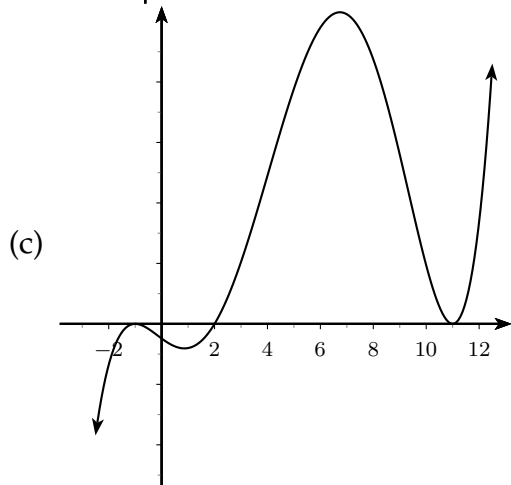
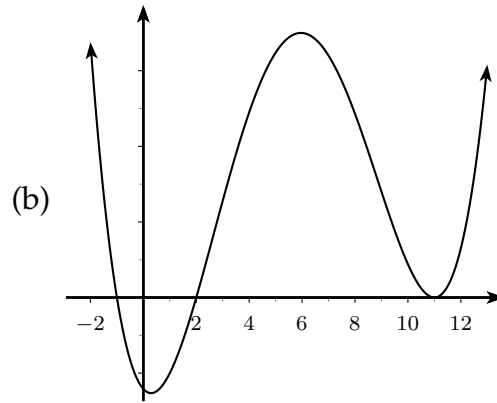
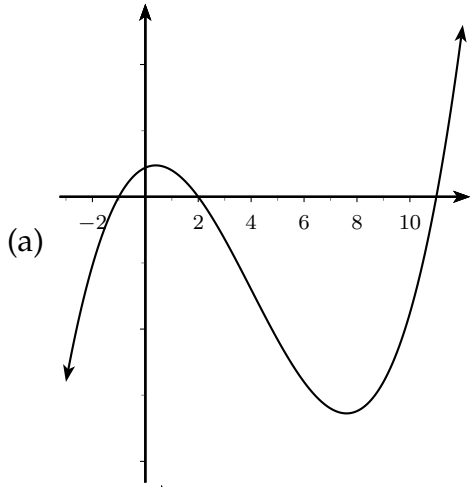
19. Joni has \$10,000. She invests a portion of her money at a simple interest rate of 4.2% and the rest of her money at a simple interest rate of 6.0%. After one year, the total interest earned on these investments is \$546.00. How much money did she invest at 4.2%?

Possibilities:

- (a) \$2000.00
 - (b) \$3000.00
 - (c) \$5000.00
 - (d) \$7000.00
 - (e) \$8000.00
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20. Use what you know about the graphs of polynomial functions to identify the best sketch of the graph of $y = (x + 1)(x - 2)(x - 11)^2$.

Possibilities:



Formula Sheet:

Compound Interest: If a principal P_0 is invested at an interest rate r for a period of t years, then the amount $P(t)$ of the investment is given by:

$$P(t) = P_0 \left(1 + \frac{r}{n}\right)^{nt} \quad (\text{if compounded } n \text{ times per year})$$

$$P(t) = P_0 e^{rt} \quad (\text{if compounded continuously}).$$

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

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