MA 109 — College Algebra
EXAM 4 - REVIEW

Name: _____ **Sec.:** _____

1. Find the vertex of $y = 4x^2 - 40x + 102$.

2. Let $f(x) = |x + 4| - 6$. Find the average rate of change of $f(x)$ between $x = -8$ and $x = 9$.

   Possibilities:

   (a) $17/9$
   (b) -9
   (c) $9/17$
   (d) $-9/17$
   (e) 9

3. Find an equation for the line that is perpendicular to $y = \frac{6}{7}x + 5$ and contains the point (0,13).

4. Solve.

$$\log_8(x - 5) + \log_8(x + 2) = 1$$

   Possibilities:

   (a) $x_1 = 6$ and $x_2 = 3$
   (b) $x_1 = 6$ and $x_2 = -3$
   (c) $x_1 = 5$
   (d) $x_1 = 5$ and $x_2 = -2$
   (e) $x_1 = 6$

5. Suppose you want to graph $x^3 - 3y = x^2$ on your graphing calculator. What should you enter into your calculator?

6. Suppose you want to graph $(y - 1)(x + 14) = x$ on your graphing calculator. What should you enter into your calculator?

7. Find the vertex of $y = 4x^2 - 40x + 102$.

8. Which of the following statements are true?

   (I) The graph of $P(x) = x^3 - 4x^2 + x + 6$ has an x-intercept at $(1, 0)$

   (II) The graph of $P(x) = x^3 - 4x^2 + x + 6$ has an x-intercept at $(-1, 0)$

   (III) $(x - 1)$ is a factor of $P(x) = x^3 - 4x^2 + x + 6$.

   (IV) $(x + 1)$ is a factor of $P(x) = x^3 - 4x^2 + x + 6$.

   Possibilities:

   (a) Only (II) and (III) are true.

   (b) Only (II) and (IV) are true.

   (c) Only (I) and (IV) are true.

   (d) Only (I) and (III) are true.

   (e) None of the statements are true.

9. Does the graph of $y = 3x^2 + 12x - 5$ have a maximum or a minimum? What is it?

10. What quantity, x, of a 55% acid solution must be mixed with a 30% acid solution to produce 800 mL of a 36.25% solution?

    Possibilities:

    (a) 300 mL

    (b) 200 mL

    (c) 700 mL

    (d) 500 mL

    (e) 600 mL

11. Find all real solutions or state that there are NONE.

$$\sqrt{x - 8} = x + 7.$$

12. Find all real solutions or state that there are NONE.

$$9e^{x-8} = 2.$$

13. Solve the equation for a.

$$4x - 16 = -2 + a.$$

14. Explain how the graph of $g(x) = (x+5)^3 - 7$ is obtained from the graph of $f(x) = x^3$.

Possibilities:

(a) Shift right 5 units and shift down 7 units.
(b) Shift left 7 units and shift down 5 units.
(c) Shift right 7 units and shift up 5 units.
(d) Shift right 5 units and shift up 7 units.
(e) Shift left 5 units and shift down 7 units.

15. Find the slope of the line through the points $(1, 4)$ and $(-9, 4)$.

16. Express the equation in logarithmic form.

$$8^3 = 512$$

Possibilities:

(a) $\log_8 512 = 3$
(b) $\log_8 3 = 512$
(c) $\log_3 512 = 8$
(d) $\log_3 8 = 512$
(e) $\log_{512} 3 = 8$

17. The endpoints of a diameter of a circle are $A(8, -9)$ and $B(-6, -2)$. Find the center of the circle.

Possibilities:

(a) $(-7, 7/2)$
(b) $(1, -11/2)$
(c) $(0, 7\sqrt{5})$
(d) $(7\sqrt{5}, 0)$
(e) $(7, -7/2)$

18. Carol has \$4000. She invests x dollars at a simple interest rate of 4% and the rest of her money at a simple interest rate of 6%. After one year, the total interest earned on these investments is \$180.00. Which of the equations below would you solve to find x?

Possibilities:

(a) $\dfrac{x}{4} + \dfrac{4000 - x}{6} = 180.00$

(b) $4x + 6(4000 - x) = 180.00$

(c) $0.04x \times 0.06(4000 - x) = 180.00$

(d) $0.04x + 0.06(4000 - x) = 180.00$

(e) $\dfrac{x}{0.04} + \dfrac{4000 - x}{0.06} = 180.00$

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19. Solve the inequality $x^2 - 5x - 15 \geq 9$. Write the solution set in interval notation.

Possibilities:

(a) $(-\infty, -8] \cup [3, \infty)$

(b) $(-\infty, -3] \cup [8, \infty)$

(c) $[-3, 8]$

(d) $[9, \infty)$

(e) $(-\infty, 9]$

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20. Which of the following statements are true?

(I) $2^{\log_2(5)} = 5$

(II) $\log(\frac{a}{b}) = \log(a) - \log(b)$ for all positive a and b.

(III) $\ln(a + b) = (\ln(a))(\ln(b))$ for all positive a and b.

Possibilities:

(a) Only (III) is true.

(b) Only (I) and (III) are true.

(c) Only (I) is true.

(d) Only (I) and (II) are true.

(e) Statements (I), (II), and (III) are all true.

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21. Find a formula for the parabola with vertex $(-5, 6)$ and that passes through the point $(-4, 9)$.

22. A ball is thrown straight upward at an initial speed of 240 feet per second. From Physics, we know that the ball will reach a height of h feet after t seconds where h and t are related by the following formula:

$$h = -16t^2 + 240t.$$

In order to determine when the ball hits the ground, you need to:

Possibilities:

(a) Find the positive h intercept of the graph of $h = -16t^2 + 240t$.

(b) Calculate the average rate of change of h with respect to t.

(c) Find the slope of a line.

(d) Find the positive t intercept of the graph of $h = -16t^2 + 240t$.

(e) Find the intervals where the graph of h is increasing and where it is decreasing.

23. Let $f(x) = \dfrac{1}{\sqrt{x-2}}$. Find the domain of $f(x)$.

Possibilities:

(a) $[2, \infty)$

(b) $(-2, \infty)$

(c) $(-\infty, 2]$

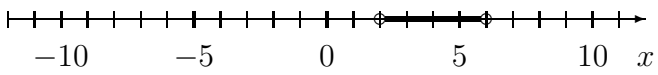
(d) $(2, \infty)$

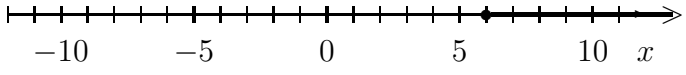
(e) $(-\infty, -2)$

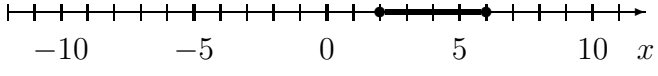
24. Solve the inequality and graph the solution set on the real number line.

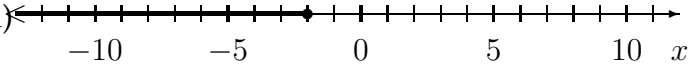
$$|x - 2| \leq 4$$

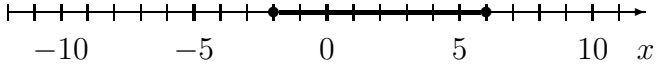
Possibilities:

(a) 

(b) 

(c) 

(d) 

(e) 

25. Let $f(x) = 2x + 7$. Find $f^{-1}(5)$.

Possibilities:

(a) 6
(b) 17
(c) -2
(d) 24
(e) -1

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26. Which of the following statements are true?

(I) If $P(x) = 3x^3 + x - 15x^2 - 5$, then $P(5) = 0$.
(II) $(5, 0)$ is an x-intercept on the graph of $y = 3x^3 + x - 15x^2 - 5$.
(III) The remainder of the division problem $\dfrac{3x^3 + x - 15x^2 - 5}{x - 5}$ is zero.
(IV) $(x - 5)$ is a factor of $3x^3 + x - 15x^2 - 5$.

Possibilities:

(a) Only (III) and (VI) are true.
(b) Only (I) and (III) are true.
(c) (I), (II), (III), and (IV) are all true.
(d) Only (I) and (II) are true.
(e) None of the statements are true.

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27. How many solutions are there for each equation?

(I) $(x - 2)^2 = 2$ **(II)** $(x + 5)^3 = 1$

Possibilities:

(a) Equation **(I)** has no solutions, and equation **(II)** has no solutions.
(b) Equation **(I)** has no solutions, and equation **(II)** has 1 solution.
(c) Equation **(I)** has 2 solutions, and equation **(II)** has 1 solution.
(d) Equation **(I)** has 2 solutions, and equation **(II)** has 3 solutions.
(e) Equation **(I)** has 1 solution, and equation **(II)** has 3 solutions.

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28. Let $f(x) = \frac{x-3}{x-4}$. Find the x and y intercepts of the graph of $y = f(x)$.

Possibilities:

(a) x-intercept: $(3, 0)$, y-intercept: $(0, 1)$

(b) x-intercept: $(1, 0)$, y-intercept: $(0, 3)$

(c) x-intercept: $(3, 0)$, y-intercept: $(0, 3/4)$

(d) x-intercept: $(1, 0)$, y-intercept: $(0, 1)$

(e) x-intercept: $(3/4, 0)$, y-intercept: $(0, 3)$

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29. Find the perimeter of the parallelogram ABCD with vertices $\mathrm{A}(1, 4)$, $\mathrm{B}(14, 4)$, $\mathrm{C}(17, 9)$, and $\mathrm{D}(4, 9)$.

Possibilities:

(a) 36 units

(b) 65 units

(c) $65/2$ units

(d) 238 units

(e) $26 + 2\sqrt{34}$ units

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30. If the GGMC corporation produces x kilograms of gadgets, then their revenue, in dollars, is given by $R(x) = 100 + 800x - .5x^2$. What is the maximum revenue and how many kilograms of gadgets should be manufactures to obtain this maximum?

Maximum Revenue: _____

Kilograms of Gadgets: _____

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31. Let $f(x) = 3x + 2$. Find the average rate of change of $f(x)$ from $x = -5$ to $x = 9$.

Possibilities:

(a) 6

(b) 2

(c) 4

(d) 5

(e) 3

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32. Solve.

$$\log_8(x-5)+\log_8(x+2)=1$$

Possibilities:

(a) $x_1 = 6$ and $x_2 = -3$

(b) $x_1 = 6$ and $x_2 = 3$

(c) $x_1 = 5$ and $x_2 = -2$

(d) $x_1 = 5$

(e) $x_1 = 6$

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33. If the GGMC corporation produces x kilograms of gadgets, then their revenue, in dollars, is given by $R(x) = 100 + 800x - .3x^2$. What is the maximum revenue and how many kilograms of gadgets should be manufactures to obtain this maximum?

Maximum Revenue: _____

Kilograms of Gadgets: _____

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34. Find the quotient and the remainder of the divsion problem.

$$\frac{6x^3+3x^2+5x-6}{x-4}$$

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35. Find all the solutions of the system of equations.

$$\begin{cases} -3x+y=4 \\ x^2-y=14 \end{cases}$$

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36. Let $f(x) = \ln(3x+7)$. Find $f^{-1}(x)$.

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37. Let $f(x) = 2e^{5x+3}$. Find $f^{-1}(x)$.

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38. Which of the following functions are one-to-one?

$$f(x) = x^2 + 3 \qquad g(x) = x^3 \qquad h(x) = 3x - 9$$

Possibilities:

(a) Only $h(x)$ is one-to-one.
(b) Only $g(x)$ and $h(x)$ are one-to-one.
(c) Only $f(x)$ and $g(x)$ are one-to-one.
(d) None of the functions are one-to-one.
(e) All of the functions are one-to-one.

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39. Find all real solutions or state that there are NONE.

$$-6x - 42 = 4x + 2.$$

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40. Let $P(x) = 4x^3 + 32x^2 - 236x + 312$. Decide which of the statements below are true.

(I) $x = 2$ is a zero of $f(x)$.
(II) $x = -2$ is a zero of $f(x)$.
(III) $x + 2$ is a factor of $f(x)$.
(IV) $x - 2$ is a factor of $f(x)$.
(V) The graph of $y = P(x)$ has an x-intercept at $(2, 0)$.
(VI) The graph of $y = P(x)$ has an x-intercept at $(-2, 0)$.

Possibilities:

(a) (I) true; (II) false; (III) true; (IV) false; (V) true; (VI) false
(b) (I) false; (II) false; (III) false; (IV) true; (V) false; (VI) true
(c) (I) true; (II) true; (III) true; (IV) true; (V) true; (VI) true
(d) (I) true; (II) false; (III) false; (IV) true; (V) true; (VI) false
(e) (I) true; (II) false; (III) false; (IV) false; (V) false; (VI) false

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41. Let $f(x) = 5x^{13} + 2x^4 - 6x + 1$. Determine the end behavior of $y = f(x)$.

Possibilities:

(a) $y \to 1$ as $x \to \infty$ and $y \to -\infty$ as $x \to -\infty$
(b) $y \to \infty$ as $x \to \infty$ and $y \to 1$ as $x \to -\infty$
(c) $y \to \infty$ as $x \to \infty$ and $y \to \infty$ as $x \to -\infty$
(d) $y \to -\infty$ as $x \to \infty$ and $y \to -\infty$ as $x \to -\infty$
(e) $y \to \infty$ as $x \to \infty$ and $y \to -\infty$ as $x \to -\infty$

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42. Find the area of the triangle with vertices $A(-2, 3)$, $B(11, 3)$, and $C(3, 8)$.

Possibilities:

(a) 65 square units

(b) $13 + \sqrt{89} + 5\sqrt{2}$ square units

(c) 66 square units

(d) 72 square units

(e) $65/2$ square units

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43. The number of bacteria in a culture is modeled by the function $n(t) = 50e^{.45t}$ where t is measured in hours. After how many hours will the number of bacteria reach 3000?

Possibilities:

(a) About 3.95 hours

(b) About 10.02 hours

(c) About 9.10 hours

(d) About 49.05 hours

(e) About 4.09 hours

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44. Find the remainder of the divsion problem.

$$\frac{x^4 - 21x^3 + 153x^2 - 455x + 450}{x - 9}$$

Let $P(x) = x^4 - 21x^3 + 153x^2 - 455x + 450$. What is $P(9)$? What is the relationship between $P(9)$ and the remainder?

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45. If \$3000 is invested at an interest rate of 8% per year compounded quarterly, find the amount of the investment at the end of 13 years.

Possibilities:

(a) \$3247.30

(b) \$4081.47

(c) \$3880.82

(d) \$8400.98

(e) \$164118.12

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46. How many solutions does the following system of equation have?

$$\begin{cases} 3x + 8y = 16 \\ 6x - 16y = 32 \end{cases}$$

Possibilities:

(a) No solutions
(b) One solution
(c) Two solutions
(d) Three solutions
(e) Infinitely many solutions

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47. Let $f(x) = 3x^2 + 5x$. Find $\dfrac{f(x+h) - f(x)}{h}$.

Possibilities:

(a) $\dfrac{3h^2 + 5h}{h}$
(b) $\dfrac{6xh + 3h^2 + 10x + 5h}{h}$
(c) $6x + 3h + 5$
(d) $-6x - 3h - 5$
(e) $3h^2 + 5h$

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48. Suppose that the graph of $y = f(x)$ contains the point (5,3). Find a point on the graph of $y = 2f(x) - 4$.

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49. Let $r(x) = \frac{x+1}{x^2-4}$. Find the horizontal asymptotes of $r(x)$.

Possibilities:

(a) $r(x)$ does not have any horizontal asymptotes.
(b) $y = 1$
(c) $y = 0$
(d) $x = 2$ and $x = -2$
(e) $x = 1$

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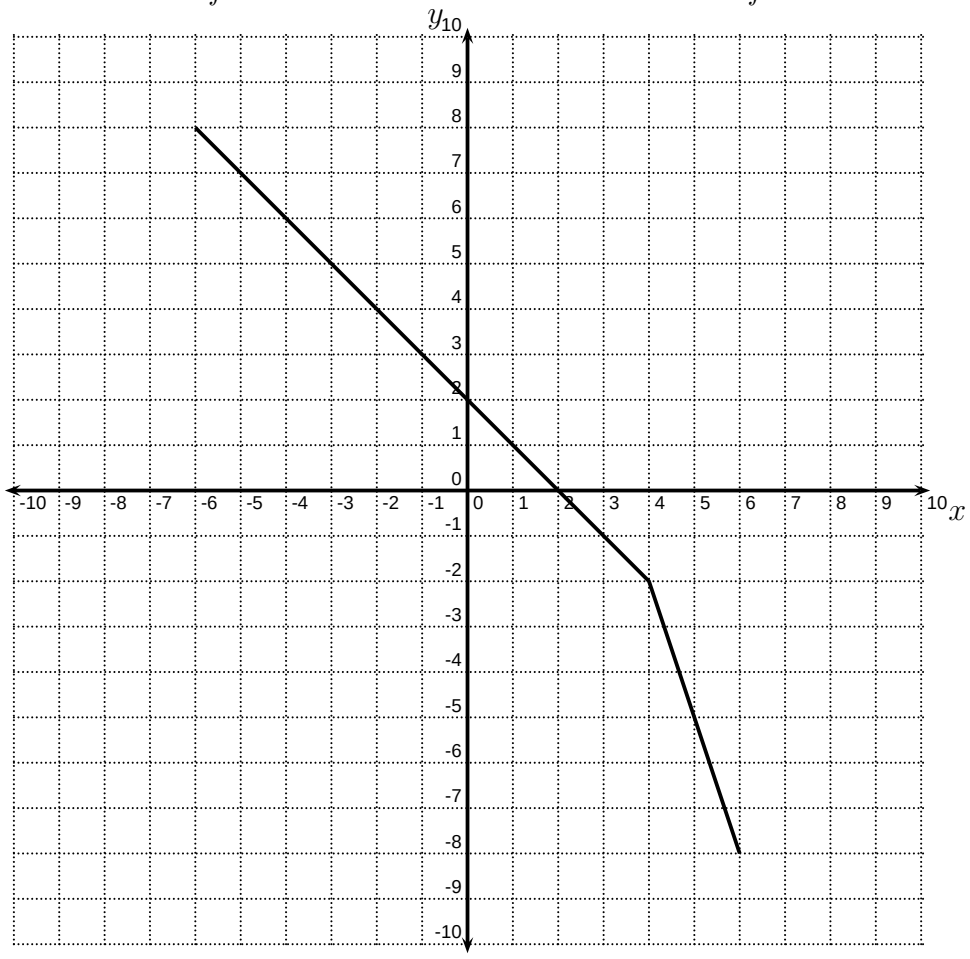
50. The graph of the one-to-one function f is shown below. Find the domain of f^{-1}.



51. Find the remainder of the divsion problem.

$$\frac{x^4 - 16x^3 + 71x^2 - 56x - 144}{x + 4}$$

Let $P(x) = x^4 - 16x^3 + 71x^2 - 56x - 144$. What is $P(-4)$? What is the relationship between $P(-4)$ and the remainder?

52. $\log\left(\dfrac{x^{-3}}{y^5 z^8}\right) =$

Possibilities:

(a) $-3\log(x) + 5\log(y) - 8\log(z)$

(b) $-3\log(x)/5\log(y) * 8\log(z)$

(c) $-3\log(x) - 5\log(y) + 8\log(z)$

(d) $-3\log(x) - 5\log(y) - 8\log(z)$

(e) $-3\log(x)/(5\log(y) * 8\log(z))$

53. Let $f(x) = x^2 - 8x + 7$. Find the y-intercept(s) of the graph of $f(x)$.

Possibilities:

(a) Both $(7, 0)$ and $(1, 0)$

(b) Only $(0, 7)$

(c) Only $(7, 0)$

(d) Both $(0, 7)$ and $(0, 1)$

(e) Both $(-7, 0)$ and $(-1, 0)$

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54. A ball is thrown straight upward at an initial speed of 200ft/sec. From Physics it is known that, after t seconds, the ball reaches a height h feet given by the formula

$$h = -16t^2 + 200t.$$

What is the maximum height reached by the ball?

Possibilities:

(a) 7.55 ft

(b) 12.50 ft

(c) 6.25 ft

(d) 625.00 ft

(e) 677.30 ft

---

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

Possibilities:

(a) $y + 5 = \frac{9}{7}(x - 2)$

(b) $y - 5 = \frac{9}{7}(x - 14)$

(c) $y - 5 = \frac{9}{7}(x + 2)$

(d) $y - 14 = -\frac{7}{9}(x - 5)$

(e) $y - 2 = -\frac{7}{9}(x - 5)$

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56. Let $f(x) = \log_2(x + 7) - 3$. Find $f^{-1}(x)$.

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57. You wish to purchase a new cell phone. You have a coupon for \$10 and the store is running a special which allows you to deduct 15% from the price. If the original price of the cell phone is 175 dollars, what is the final price if you apply the coupon and then apply the 15% discount.

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58. Joni invests \$5000 at an interest rate of 5% per year compounded continuously. How much time will it take for the value of the investment to quadruple? Round your answer to the nearest tenth of a year.

Possibilities:

(a) 20.0 years
(b) 32.2 years
(c) 22.0 years
(d) 13.9 years
(e) 27.7 years

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59. Let $r(x) = \frac{x^2+x-90}{x^2-9x+18}$. Find the vertical asymptotes of $r(x)$.

Possibilities:

(a) $x = 9$ and $x = -10$
(b) $y = 9$ and $y = -10$
(c) $x = 3$ and $x = 6$
(d) $y = 3$ and $y = 6$
(e) $r(x)$ does not have any vertical asymptotes.

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60. Let $P(x) = 8x^7 + 4x + 7$. List all possible rational zeros of $P(x)$ given by the Rational Zeros Theorem (but do not check to see which are actually zeros).

Possibilities:

(a) $\pm 1, \pm 8, \pm 8/7$
(b) $\pm 1, \pm 2, \pm 4, \pm 8, \pm 7, \pm 7/2, \pm 7/4, \pm 7/8$
(c) $\pm 1, \pm 1/2, \pm 1/4, \pm 1/8, \pm 7, \pm 7/2, \pm 7/4, \pm 7/8$
(d) $\pm 1, \pm 2, \pm 4, \pm 8, \pm 1/7, \pm 2/7, \pm 4/7, \pm 8/7$
(e) $\pm 1, \pm 8, \pm 7/8$

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61. Let $f(x) = 2x^2 + 4x$. Find $f(x + 4)$.

Possibilities:

(a) $2x^2 + 4x + 4$
(b) $2x^2 + 5x + 4$
(c) $2x^2 + 4x + 48$
(d) $96x^2 + 192x$
(e) $2x^2 + 20x + 48$

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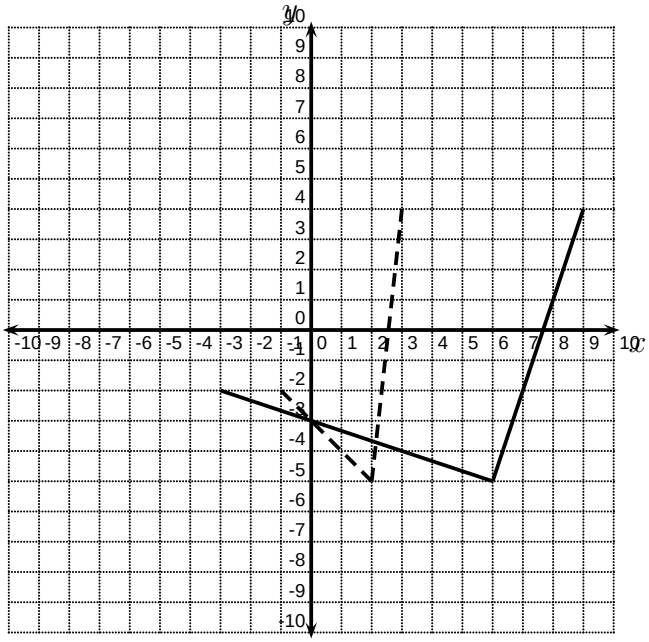
62. Let $f(x) = \dfrac{2x+3}{4-5x}$. Find $f^{-1}(x)$.

63. 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 a formula for $g(x)$.



Possibilities:

(a) $g(x) = -3f(x)$

(b) $g(x) = f\left(\frac{1}{3}x\right)$

(c) $g(x) = 3f(x)$

(d) $g(x) = \frac{1}{3}f(x)$

(e) $g(x) = f(3x)$

64. Find the vertex of $y = -4x^2 - 24x - 29$.

65. Does the graph of $y = 3x^2 + 12x - 5$ have a maximum or a minimum? What is it?

66. Let $P(x) = 4x^2 + 3x + 25$. Find the y-intercept of the graph of $y = P(x)$.

67.

$$f(x) = \begin{cases} x + 9 & \text{if } x \leq 4 \\ x - 9 & \text{if } x > 4 \end{cases}$$

Find $f(12)$.

Possibilities:

(a) 7
(b) 63
(c) 21
(d) Both 21 and 3.
(e) 3

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68. Find all of the zeros of $P(x) = x^3 + 5x^2 + 4x$.

Possibilities:

(a) 0,-1,4
(b) 0,-1,-4
(c) -1,-4,1
(d) -1,-4,3
(e) 0,1,4

---

69. Simplify.

$$(9x + 8)(2x - 5) - 16x - 64$$

Possibilities:

(a) $18x^2 - 45x - 104$
(b) $18x^2 - 29x - 32$
(c) $18x - 48$
(d) $25x + 3$
(e) $18x^2 - 45x + 24$

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70. Find all real solutions or state that there are NONE.

$$x^2 - 7x + 13 = 3.$$

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71. Find all real solutions or state that there are NONE.

$$\frac{3}{x+6} + \frac{7}{x+7} = \frac{5}{x^2 + 13x + 42}.$$

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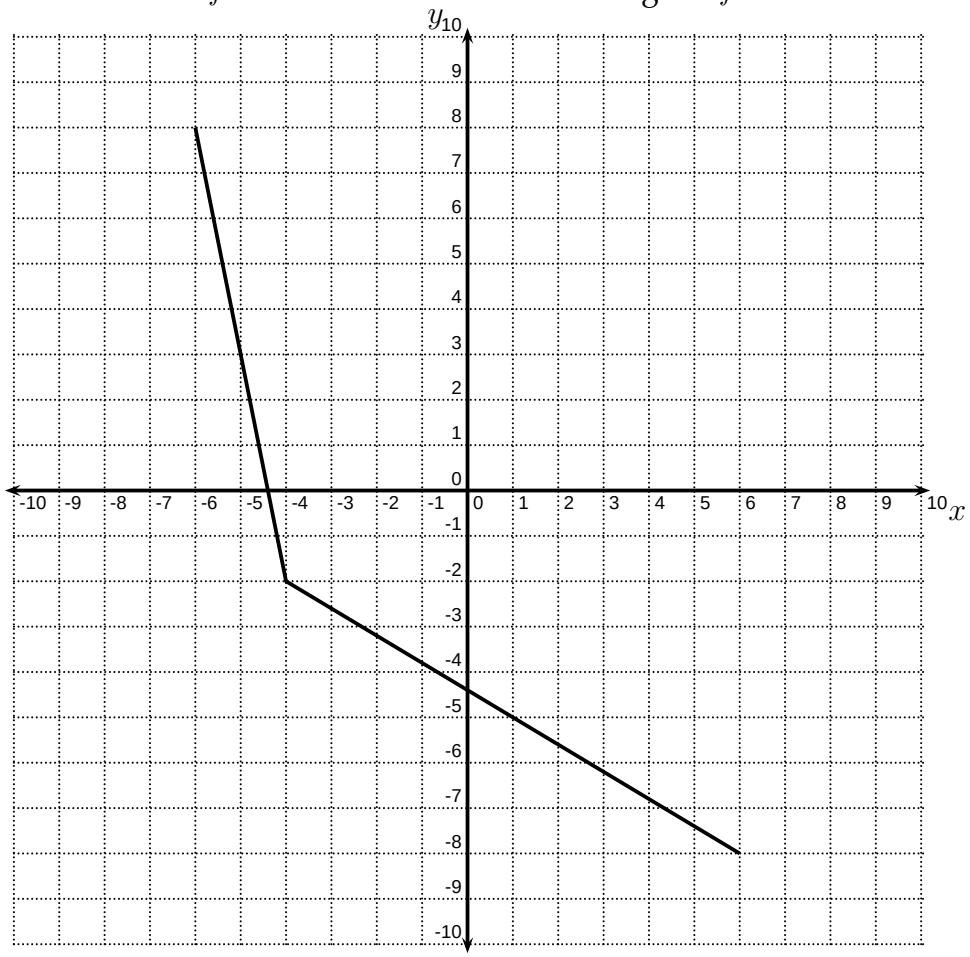
72. The graph of the one-to-one function f is shown below. Find the range of f^{-1}.



73. Solve.

$$\frac{9}{x} + \frac{4}{x-5} = 0$$

Possibilities:

(a) 9

(b) 45/13

(c) 5/13

(d) 20/13

(e) 1

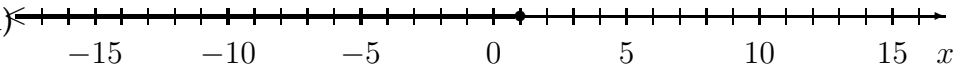
74. Find a polynomial of degree 3 that has zeros -3, 3, and 6 and in which the coefficient of x^2 is -60.

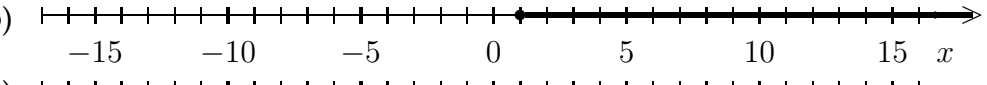
Polynomial: _____

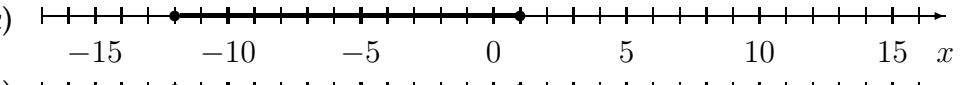
75. Solve the inequality and graph the solution set on the real number line.

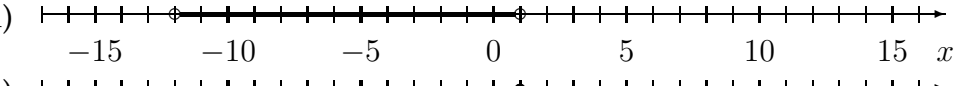
$$|2x + 11| \leq 13$$

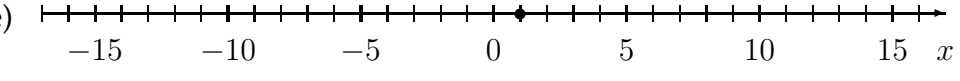
Possibilities:

(a) 

(b) 

(c) 

(d) 

(e) 

76. Find the vertex of the parabola given by $y = 3x^2 - 5x + 9$.

Possibilities:

(a) $(-5/6, -83/12)$

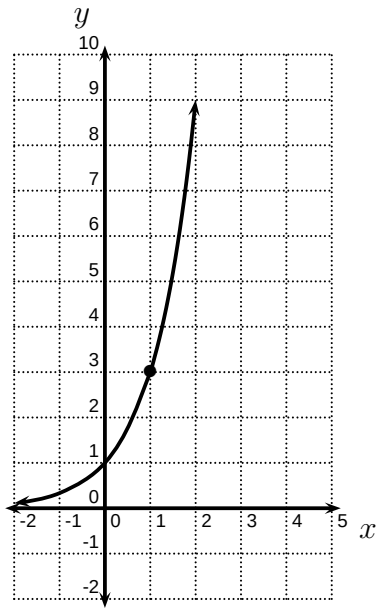
(b) $(5/6, 83/12)$

(c) $(61/4, 5/6)$

(d) $(83/12, 5/6)$

(e) $(-5/6, 61/4)$

77. The graph of an exponential function, $f(x) = a^x$ is shown below. Find a.



Possibilities:

(a) $\frac{1}{4}$

(b) 3

(c) $\frac{1}{3}$

(d) 4

(e) 2

78. Let $P(x) = x^4 - 17x^2 - x^3 - 3x - 60$. Find the real zeros of P(x).

79. Let $P(x) = 2x^3 + x^2 - 16x - 15$. Find the real zeros of P(x).

80. Does the graph of $P(x) = (x-5)^{900}(x+4)^{901}$ cross the x-axis at $x = 5$?

81. Does the graph of $P(x) = (x-5)^{900}(x+4)^{901}$ cross the x-axis at $x = -4$?

82. Find the remainder of the divsion problem.

$$\frac{x^4 - 24x^3 + 207x^2 - 756x + 972}{x - 9}$$

Let $P(x) = x^4 - 24x^3 + 207x^2 - 756x + 972$. What is $P(9)$? What is the relationship between $P(9)$ and the remainder?

83. Find the quotient and the remainder of the divsion problem.

$$\frac{x^4 - 18x^3 + 105x^2 - 232x + 144}{x - 9}$$

84. Determine the end behavior of P(x)=$3x^{56} - 7x^3 + 21$.

85. Determine the end behavior of P(x)=$5x - 3 - x^{99}$.

86. Let $P(x) = 4x^3 - 88x^2 + 364x - 408$. Decide which of the statements below are true.

(I) $x = 2$ is a zero of $f(x)$.
(II) $x = -2$ is a zero of $f(x)$.
(III) $x + 2$ is a factor of $f(x)$.
(IV) $x - 2$ is a factor of $f(x)$.
(V) The graph of $y = P(x)$ has an x-intercept at $(2, 0)$.
(VI) The graph of $y = P(x)$ has an x-intercept at $(-2, 0)$.

Possibilities:

(a) (I) false; (II) false; (III) false; (IV) true; (V) false; (VI) true
(b) (I) true; (II) false; (III) true; (IV) false; (V) true; (VI) false
(c) (I) true; (II) false; (III) false; (IV) false; (V) false; (VI) false
(d) (I) true; (II) true; (III) true; (IV) true; (V) true; (VI) true
(e) (I) true; (II) false; (III) false; (IV) true; (V) true; (VI) false

---

87. Which of the following statements are true?

(I) If $P(x) = 3x^3 + x + 15x^2 + 5$, then $P(5) = 0$.
(II) $(5, 0)$ is an x-intercept on the graph of $y = 3x^3 + x + 15x^2 + 5$.
(III) The remainder of the division problem $\dfrac{3x^3 + x + 15x^2 + 5}{x - 5}$ is zero.
(IV) $(x - 5)$ is a factor of $3x^3 + x + 15x^2 + 5$.

Possibilities:

(a) (I), (II), (III), and (IV) are all true.
(b) Only (III) and (VI) are true.
(c) Only (I) and (III) are true.
(d) Only (I) and (II) are true.
(e) None of the statements are true.

---

88. Find the quotient and the remainder of the divsion problem.

$$\frac{6x^4 + 3x^3 + 2x + 1}{x^2 - 6}$$

---

89. Find the quotient and the remainder of the divsion problem.

$$\frac{4x^3 - 3x^2 + 5x - 6}{x - 6}$$

90. Find the remainder of the divsion problem.

$$\frac{x^4 - 20x^3 + 123x^2 - 180x - 324}{x + 4}$$

Let $P(x) = x^4 - 20x^3 + 123x^2 - 180x - 324$. What is $P(-4)$? What is the relationship between $P(-4)$ and the remainder?

91. Solve the inequality.

$$\frac{x + 7}{x - 5} \geq 0$$

Possibilities:

(a) $(-\infty, -7] \cup (5, \infty)$
(b) $(-\infty, -7) \cup (5, \infty)$
(c) $[-7, 5]$
(d) $(-7, 5)$
(e) $[-7, 5)$

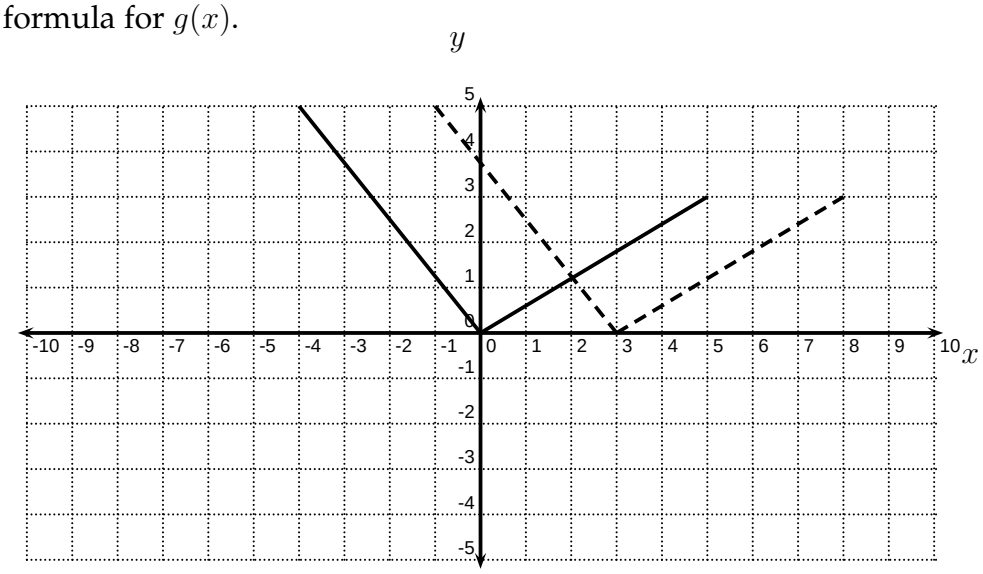
92. Solve the inequality.

$$(x + 7)(x - 5) < 0$$

Possibilities:

(a) $(-\infty, \infty)$
(b) $(-\infty, -7) \cup (5, \infty)$
(c) $[-7, 5]$
(d) $(-7, 5)$
(e) $(-\infty, -7] \cup [5, \infty)$

93. 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 a formula for $g(x)$.



Possibilities:

(a) $g(x) = f(x-3)$
(b) $g(x) = f(x) - 3$
(c) $g(x) = f(x) + 3$
(d) $g(x) = -3f(x)$
(e) $g(x) = f(x+3)$

---

94. Find all of the zeros of $P(x) = x^3 - 4x^2 - 12x$.

Possibilities:

(a) 0,6,-2
(b) 0,6,2
(c) 6,-2,8
(d) 0,-6,2
(e) 6,-2,-6

---

95. Let $f(x) = 3x - 2$ and $g(x) = x^2$. Find $g(f(x))$.

Possibilities:

(a) $9x^2 - 12x + 4$
(b) $3x^2 - 2$
(c) $3x^3 - 2x^2$
(d) $9x^2 - 4$
(e) $9x^2 + 4$

---

96. Find all of the zeros of $P(x) = x^3 + 10x^2 + 24x$.

Possibilities:

(a) -4,-6,4
(b) -4,-6,2
(c) 0,-4,-6
(d) 0,-4,6
(e) 0,4,6

---

97. Determine the end behavior of P(x)=$-2x^{44} + 3x^{33}$.

---

98. Determine the end behavior of P(x)=$2x^{515} + 2x^{514}$.

---

99. Which of the following statements are true?

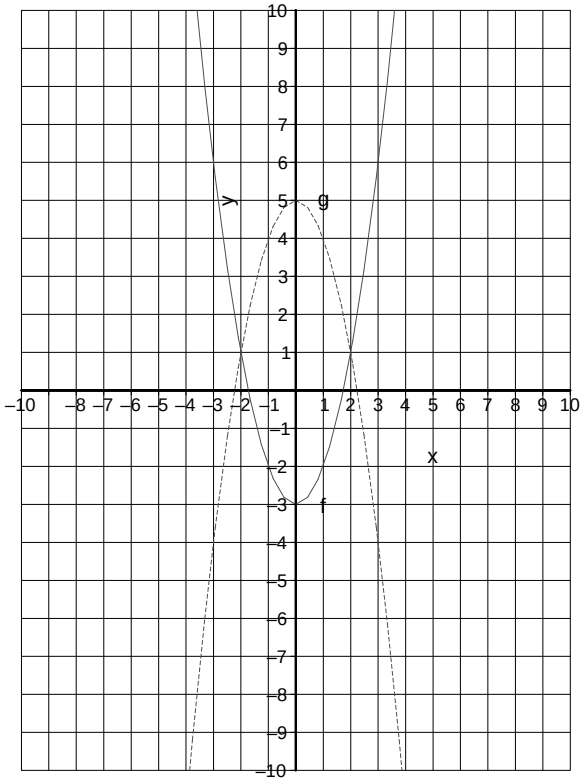
(I) If $P(x) = 3x^3 + x - 21x^2 - 7$, then $P(7) = 0$.
(II) $(7, 0)$ is an x-intercept on the graph of $y = 3x^3 + x - 21x^2 - 7$.
(III) The remainder of the division problem $\dfrac{3x^3 + x - 21x^2 - 7}{x - 7}$ is zero.
(IV) $(x - 7)$ is a factor of $3x^3 + x - 21x^2 - 7$.

Possibilities:

(a) (I), (II), (III), and (IV) are all true.
(b) Only (I) and (II) are true.
(c) Only (III) and (VI) are true.
(d) Only (I) and (III) are true.
(e) None of the statements are true.

---

100. In the graph below, the solid graph is the graph of $y = f(x)$ and the dashed graph is the graph of $y = g(x)$. Which of the following statements are true?



(I) $f(0) < g(0)$ **(II)** $f(1) = g(1)$ **(III)** $f(2) > g(2)$

Possibilities:

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

---

101. Let $f(x) = -5x^9 + 800x^4 - 6x + 1$. Determine the end behavior of $y = f(x)$.

Possibilities:

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

---

102. Find a formula for the parabola with vertex $(4, -4)$ and that passes through the point $(5, -2)$.

---

103. If the GGMC corporation produces x kilograms of gadgets, then their revenue, in dollars, is given by $R(x) = 100 + 700x - .2x^2$. What is the maximum revenue and how many kilograms of gadgets should be manufactures to obtain this maximum?

Maximum Revenue: _____

Kilograms of Gadgets: _____

---

104. Let $P(x) = x^3 - 3x - 2x^2 + 6$. Find the real zeros of P(x).

---

105. Let $P(x) = 7x^{15} - 2x^7 + 3x^2 + 8$. List all possible rational zeros of $P(x)$ given by the Rational Zeros Theorem (but do not check to see which are actually zeros).

Possibilities:

(a) $\pm 1, \pm 8, \pm 8/7$

(b) $\pm 1, \pm 2, \pm 4, \pm 8, \pm 7, \pm 7/2, \pm 7/4, \pm 7/8$

(c) $\pm 1, \pm 8, \pm 7/8$

(d) $\pm 1, \pm 1/2, \pm 1/4, \pm 1/8, \pm 7, \pm 7/2, \pm 7/4, \pm 7/8$

(e) $\pm 1, \pm 2, \pm 4, \pm 8, \pm 1/7, \pm 2/7, \pm 4/7, \pm 8/7$

---

106. Let $f(x) = 3x^2 + 2x + 1$. Find $\dfrac{f(x+h) - f(x)}{h}$

---

107. Find an equation for the line that is perpendicular to $y = \dfrac{5}{6}x + 4$ and passes through the point (4,7).

---

108. Solve the inequality.

$$\frac{x-1}{(x-14)^2} > 0$$

Possibilities:

(a) $(1, 14)$

(b) $(-\infty, 1) \cup (14, \infty)$

(c) $(-1, 14)$

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

(e) $(1, 14) \cup (14, \infty)$

---

109. Which of the following equations are linear equations?

(I) $y - 2 = x + 3$ **(II)** $y = (\sqrt{2})x$ **(III)** $y = \sqrt{2x}$

Possibilities:

(a) All of the equations are linear.
(b) None of the equations are linear.
(c) Only equation **(I)** is linear.
(d) Only equations **(I)** and **(II)** are linear
(e) Only equations **(II)** and **(III)** are linear

---

110. Which of the following are equations for the line through the points $P(-2, 4)$ and $Q(5, 6)$?

(I) $y - 6 = \frac{2}{7}(x - 5)$ **(II)** $y = \frac{2}{7}x - 6$
(III) $y = \frac{2}{7}(x + 2) + 4$ **(IV)** $y + 4 = \frac{2}{7}(x - 2)$

Possibilities:

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

---

111. Let $f(x) = x^2 + 5x$. Find the average rate of change of $f(x)$ from $x = a$ to $x = a + h$. Assume $h \neq 0$.

Possibilities:

(a) $\frac{h^2 + 5h}{h}$
(b) $\frac{2ah + h^2 + 10a + 5h}{h}$
(c) $-2a - h - 5$
(d) $2a + h + 5$
(e) 1

---

112. A train leaves Lexington for Indianapolis, 200 miles away, at 1:00 PM and averages 60 miles per hour. A second train travelling on an adjacent track leaves Indianapolis for Lexington at 3:30 PM and averages 40 miles per hour. At what time will the trains meet? (Round to the nearest minute.)

Possibilities:

(a) 5:00PM
(b) 4:00PM
(c) 5:30PM
(d) 4:30PM
(e) 6:00PM

---

113. Approximate the solution to $8x^3 + 24x^2 + 24x + 8 = 9$.

Possibilities:

(a) $x \approx 0.0200$
(b) $x \approx 0.0139$
(c) $x \approx 0.0400$
(d) $x \approx -0.3920$
(e) $x \approx 9.0000$

---

114. A corner lot has dimensions 30 yards by 20 yards. The city plans to take a strip of uniform width along the two sides bordering the streets to widen these roads. How wide should the strip be if the remainder of the lot has an area of 459 square yards?

Possibilities:

(a) 30 yards
(b) 3 yards
(c) 459 yards
(d) 1 yard
(e) 10 yards

---

115. Which of the following windows is an appropriate viewing window for $y = 18x - 3x^2$?

Possibilities:

(a) $-5 \leq x \leq 25, 0 \leq y \leq 20$
(b) $-10 \leq x \leq 10, -50 \leq y \leq 50$
(c) $-30 \leq x \leq 15, -100 \leq y \leq 250$
(d) $-10 \leq x \leq 10, -10 \leq y \leq 10$
(e) None of the above windows gives a complete graph.

Short Answer Questions

Clearly write your final answer on the front page of the exam.

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116. Let $P(x) = 2x^7 - 493x^5 + 1050$. Find the y-intercept of the graph of $y = P(x)$.

---

117. A manufacturer finds that the revenue generated by selling x gadgets is given by the function $R(x) = 340x - .8x^2$, where the revenue $R(x)$ is is measured in dollars. What is the maximum revenue?

---

118. Find the **remainder** of the divsion problem.

$$\frac{x^4 + 7x^3 - 9x^2 - 115x - 100}{x - 1}$$

---

119. Let $f(x) = 2x^2 - 36x + 155$. Answer the following questions about the graph of $y = f(x)$.

    (a) Does the graph of $y = f(x)$ have a minimum or a maximum at its vertex?

    (b) What is the vertex of $y = f(x)$?
