Note.

This is the second problem set of the Math 110/112 study aid. The formulas at the end of the third problem set will be identical to the formulas given on the final exam.

Problem Set #2

1. Which of the following tables determine y as a function of x?

(1)

x	y
4	1
5	3
7	3
8	4

(2)

x	y
4	1
5	2
6	4
4	5

(3)

x	y
1	8
2	4
3	2
2	4

(A) 1 only (B) 2 only (C) 3 only

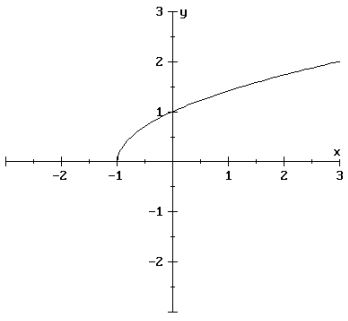
(D) 1 and 3 only (E) 2 and 3 only

2. If $f(x) = 3x^2 - 2$, find $f(b - 2)$.

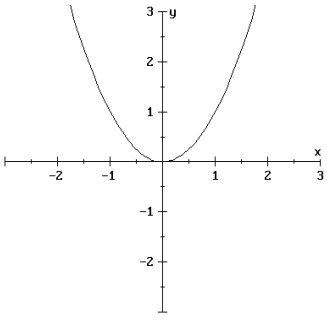
(A) $3b^2 - 12b + 12$ (B) $3b^2 - 8$ (C) $3b^2 - 4b + 2$

(D) $3b^2 - 4$ (E) None of these

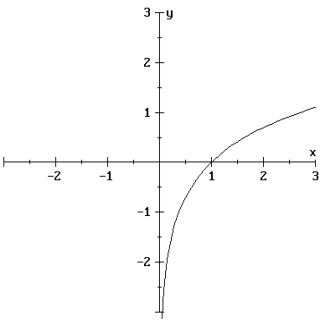
3. Which of the following have a RANGE of $[0, \infty)$?



(1)



(2)



(3)

(A) 2 only (B) 1 and 3 only (C) 1 only

(D) 1 and 2 only (E) All of them

4. Find the zeros of the function $g(x) = \dfrac{3x^2 - 5x + 2}{\sqrt{x+2}}$

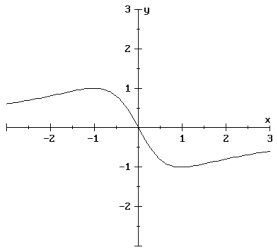
(A) $\frac{2}{3}$, 1 and -2 only (B) $\frac{1}{3}$, 2, and -2 only (C) $-\frac{2}{3}$ and -1 only

(D) $\frac{1}{3}$ and 2 only (E) $\frac{2}{3}$ and 1 only

5. Which of the following functions are neither even nor odd?

(1) $f(x) = |15x|$ (2) $f(x) = \dfrac{2x}{x^2 + 15}$ (3) $f(x) = 217 - 3x - x^3$

(4)



(A) All of them (B) None of them (C) 2 and 3 only (D) 3 only (E) 2 only

Consider the following problem: In 1990 Joe bought a BMW for \$40,000; it depreciates \$4,000 each year. Tom bought a classic '57 Chevy for \$10,000 and it appreciates \$1,000 each year. Use this information to answer the next TWO questions.

6. Write a system of equations for the values (V) of these cars in terms of the number of years (t). $\left[t = 0 \text{ is } 1990 \right]$

(A) BMW : $V = 40,000 - 4000t$
Chevy: $V = 10,000 + 1000t$

(B) BMW: $V = 40,000 + 4000t$
Chevy: $V = 10,000 - 1000t$

(C) BMW : $V = 40,000 - t$
Chevy: $V = 10,000 + t$

(D) BMW: $V = t + 40,000$
Chevy: $V = t + 10,000$

(E) None of these

7. How many years must pass before the values of both cars are equal? The answer is a number:

(A) between 1 and 5 (B) between 5 and 10 (C) more than 10

(D) never equal (E) None of these

8. Suppose that a function $f(x)$ has a domain of $[-10, 10]$ and a range of $[-4, 6]$. Which of the following would be the domain of $g(x) = f(2x) - 5$.

(A) Domain: $[-10, 10]$
Range: $[-8, 12]$

(B) Domain: $[-20, 20]$
Range: $[-9, 1]$

(C) Domain: $[-15, 5]$
Range: $[-8, 12]$

(D) Domain: $[-5, 5]$
Range: $[-9, 1]$

(E) None of these

9. Given the values for $f(x)$ and $w(x)$ below:

x	0	1	2	3	4	5	6	7
$f(x)$	0	0.3	2	2.3	3	3.3	4	4.3

x	−2	−1	0	1	2	3	4	5
$w(x)$	0	0.3	2	2.3	3	3.3	4	4.3

Find an equation for $w(x)$ relative to $f(x)$.

(A) $w(x) = f(x) - 2$ (B) $w(x) = f(x + 2)$ (C) $w(x) = f(x - 2)$

(D) $w(x) = f(x) + 2$ (E) None of these

10. Given $f(x) = \log_4(-8x)$ and $h(x) = x - 3$, find $(h \circ f)(-2)$.

(A) 1 (B) 10 (C) -1 (D) 0 (E) None of these

11. Suppose that $h(x) = f(g(x))$. If $h(x) = \frac{1}{(x+3)^2}$, which of the following is NOT a possible choice for $f(x)$ and $g(x)$?

(A) $f(x) = \frac{1}{x^2}$ and $g(x) = x + 3$ (B) $f(x) = \frac{1}{x}$ and $g(x) = (x+3)^2$

(C) $f(x) = x + 3$ and $g(x) = \frac{1}{x^2}$ (D) $f(x) = x$ and $g(x) = (x+3)^{-2}$

12. What is the equation of the line PERPENDICULAR to $3y + 2x - 3 = 0$, passing through the point $(4, -1)$?

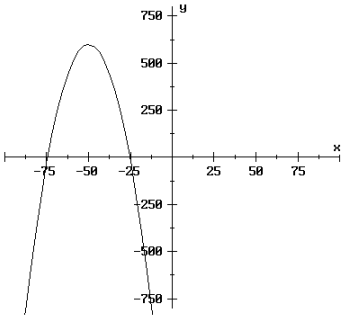
(A) $2y - 3x + 14 = 0$ (B) $2y + 3x - 10 = 0$ (C) $3y + 2x - 5 = 0$

(D) $3y + 2x + 11 = 0$ (E) None of these

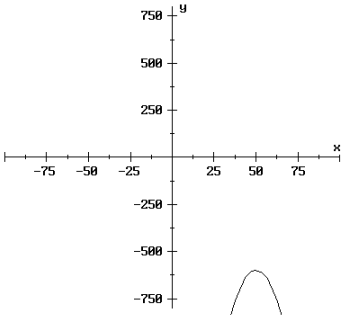
13. Which of the following graphs best represents:

$$f(x) = 600 - (x - 50)^2$$

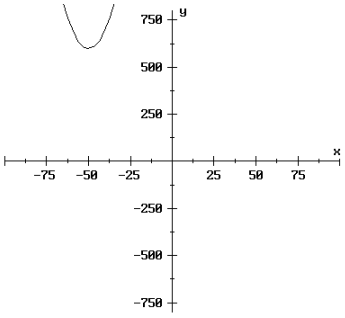
(A)



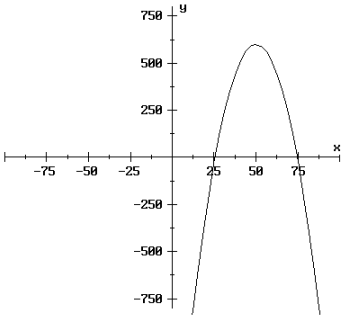
(B)



(C)



(D)



14. Find the vertex of the quadratic function $y = x^2 + 2ax + b$. The y-coordinate of the vertex is:

(A) b (B) $-b$ (C) $\frac{b^2}{4a^2} - b$ (D) $-a^2 + b$ (E) $3a^2 + b$

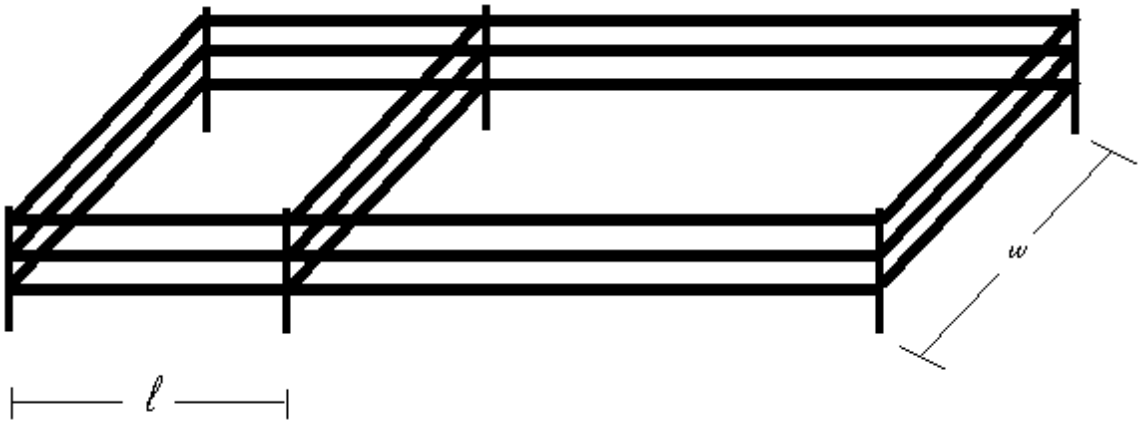
15. Find the equation of the parabola that has a vertex of $(3, -1)$ and passes through the point $(4, 1)$. The coefficient of x^2 is a number:

(A) between -2 and -0.5 (B) between -0.5 and 1.5

(C) between 1.5 and 3 (D) between 3 and 4.5

(E) None of these

16. A rancher wishes to enclose two adjacent rectangular corrals such that the right-hand corral has twice the length of the left hand (see diagram). She has 900 feet of fencing. What is the maximum area she can enclose?



(A) 22,500 sq. ft. (B) 50,625 sq. ft. (C) 62,500 sq. ft.

(D) 67,500 sq. ft. (E) None of these

17. For the graph of $y = -3x^4 + 37x^3 + 28x^2 + 42$, which of the following is correct?

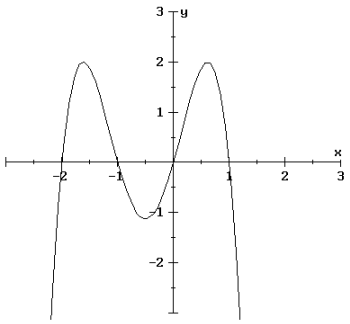
(A) $y \to -\infty$ as $x \to -\infty$
$y \to \infty$ as $x \to \infty$

(B) $y \to -\infty$ as $x \to -\infty$
$y \to -\infty$ as $x \to \infty$

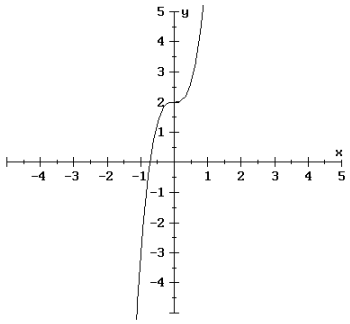
(C) $y \to \infty$ as $x \to -\infty$
$y \to \infty$ as $x \to \infty$

(D) $y \to \infty$ as $x \to -\infty$
$y \to -\infty$ as $x \to \infty$

18. Which of the following could be the graph of a polynomial of odd degree?



(1)



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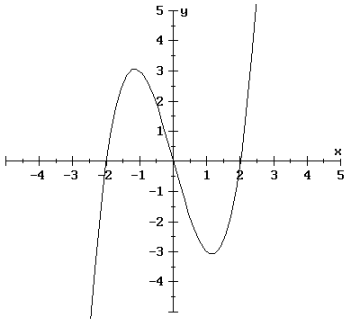

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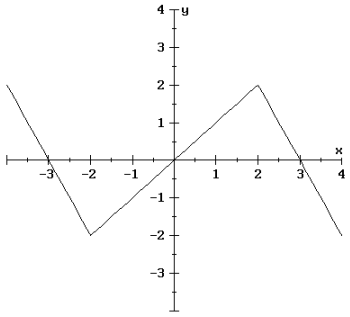


(4)

(A) All of them (B) None of them (C) 1, 2 and 3 only

(D) 1, 2 and 4 only (E) 2 and 3 only

19. Find all real zeros of $f(x) = 3x^4 - 36x^2 + 60$. The SMALLEST real zero of $f(x)$ is:

(A) $-\sqrt{2}$ (B) $\frac{7}{5}$ (C) $-\frac{16}{5}$ (D) $-\sqrt{10}$ (E) $\sqrt{2}$

20. What is the remainder when $p(x) = x^4 + x^3 - x^2 - 2$ is divided by $x + 3$?

(A) −26 (B) 43 (C) −17 (D) 0 (E) None of these

21. Find a polynomial of lowest degree having zeros $-2, 1, 0$ (a zero of multiplicity 2), and -4 (a zero of multiplicity 3).

(A) $f(x) = x^2(x+2)(x-1)(x+4)^3$ (B) $f(x) = x^2(x-2)(x+1)(x-4)^3$

(C) $f(x) = 2x(x+2)(x-1)(x+4)^3$ (D) $f(x) = (x+2)(x-1)(x+4)^3$

(E) None of these

22. Find all rational zeros of $p(x) = x^4 - 4x^3 + 2x^2 + 5x - 2$. The SUM of all the RATIONAL zeros is:

(A) 1 (B) 2 (C) -1 (D) 0 (E) There are no rational zeros

23. Determine the behavior of the function $f(x) = \frac{2x+1}{1-18x}$ as $x \to \infty$.

(A) $y \to -\frac{1}{9}$ (B) $y \to 2$ (C) $y \to 0$ (D) $y \to \infty$

(E) $y \to \frac{1}{18}$

24. Which of the following is/are TRUE about the function $R(x) = \frac{15}{x^2 - x - 6}$

(1) $x = 15$ is a zero of $R(x)$.

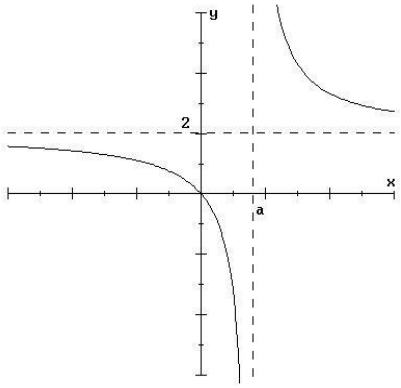
(2) $R(x)$ has a y-intercept of $(0, -\frac{5}{2})$.

(3) $R(x)$ has no real zeros.

(A) 1 only (B) 2 only (C) 3 only

(D) 2 and 3 only (E) 1 and 2 only

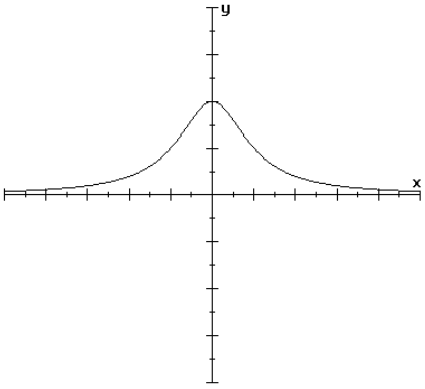
25. Find a formula for the rational function show below.



(A) $y = \frac{2}{x-a}$ (B) $y = \frac{2x}{x+a}$ (C) $y = \frac{2x}{x-a}$

(D) $y = \frac{x+2}{x-a}$ (E) $y = \frac{x-a}{2x}$

26. If $y = \frac{1}{f(x)}$ is the equation for the graph below, which of the following are NOT possible expressions for $f(x)$?



(1) $x - 4$ (2) $x^2 + 1$ (3) $x^2 - 4$ (4) x

(A) 2 only (B) 1 and 4 only (C) 2 and 3 only

(D) 1, 3 and 4 only (E) All are possible

27. Which of the following is/are correct for the function $f(x) = a^{-x} (a > 1)$?

(1) $f(x)$ is decreasing (2) The domain is $(-\infty, 0]$

(3) The range is $(0, \infty)$ (4) The y-intercept is $(0, 1)$

(A) 1 and 4 only (B) 3 and 4 only (C) 1 only

(D) 1, 3 and 4 only (E) 2 only

28. If $G(x) = \sqrt[3]{4 - x}$, what is $G^{-1}(x)$?

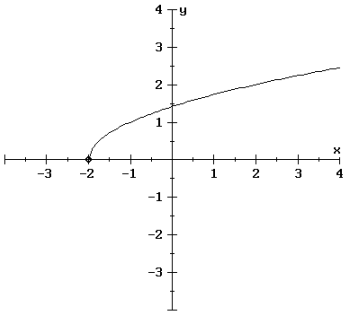
(A) $G^{-1}(x) = \dfrac{1}{\sqrt[3]{4 - x}}$ (B) $G^{-1}(x) = -\sqrt[3]{4 - x}$ (C) $G^{-1}(x) = 4 - x^3$

(D) $G^{-1}(x) = x^3 + 4$ (E) None of these

29. If the point $(2, 6)$ is on the graph of $f(x)$, which of the following points must be on the graph of $f^{-1}(x)$?

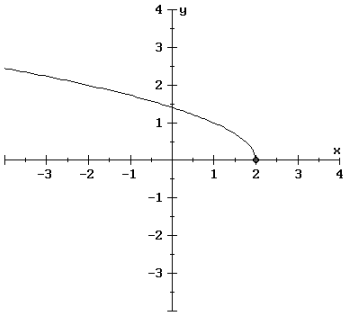
(A) $(-2, -6)$ (B) $\left(2, \dfrac{1}{6}\right)$ (C) $(6, 2)$ (D) $(2, -6)$ (E) None of these

30. If the graph of $S(x)$ is:

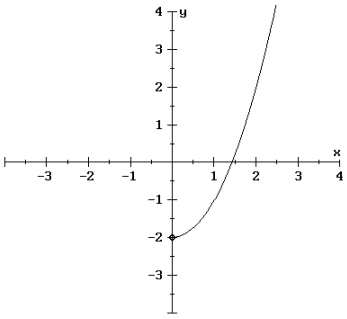


Then the graph of $S^{-1}(x)$ is:

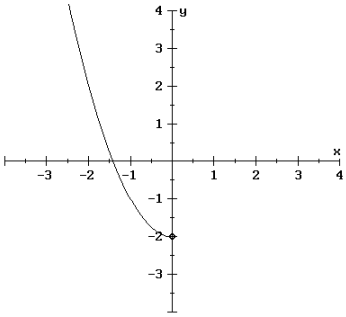
(A)



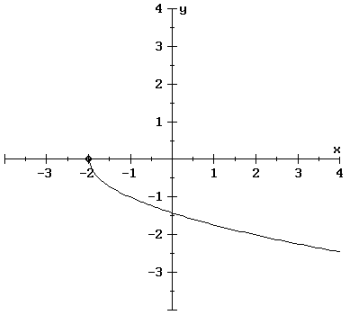
(B)



(C)



(D)



(E) None of these

31. Suppose $f(3) = 20$ means the volume of water in a container is 20 ounces when the depth of the water is 3 inches. What is the meaning of $f^{-1}(10) = 2$?

(A) The volume of water is 2 ounces when the depth of the water is 10 inches.

(B) The depth of the water is 2 inches when the volume of the water is 10 ounces.

(C) The depth of the water is $\frac{1}{2}$ inch when the volume of the water is 10 ounces.

(D) Not enough information is given.

32. What is the domain of $y = 10 - \log_7(5n - 230)$?

(A) $(-\infty, 230]$ (B) $[46, \infty)$ (C) $(46, \infty)$

(D) $(230, \infty)$ (E) $(-\infty, 48)$

33. For the natural log function $y = \ln(x)$, which of the following is/are correct?

(1) The graph is increasing (2) The x-intercept is $(1, 0)$

(3) The graph is continuous (4) The y-intercept is $(0, e)$

(A) All of them (B) 1, 2 and 3 only (C) 2, 3 and 4 only

(D) 2 and 3 only (E) 1 and 2 only

34. Express as a sum or difference of the natural logarithms of $x, y,$ and z: $\ln\sqrt{\frac{x^3y}{z^4}}$

(A) $\frac{(3\ln x)(\ln y)}{4\ln z}$ (B) $\frac{3}{2}\ln x + \ln y - 4\ln z$

(C) $\frac{3}{2}\ln x + \frac{1}{2}\ln y - 2\ln z$ (D) $6\ln x + 2\ln y - 4\ln z$

(E) None of these

35. Which of the following is true about the graph of $y = 5000e^{-0.0002t} - 9000$?

(A) $y \to \infty$ as $t \to -\infty$ and $y \to 9000$ as $t \to \infty$

(B) $y \to \infty$ as $t \to -\infty$ and $y \to -9000$ as $t \to \infty$

(C) $y \to 5000$ as $t \to -\infty$ and $y \to -9000$ as $t \to \infty$

(D) $y \to 0$ as $t \to -\infty$ and $y \to \infty$ as $t \to \infty$

(E) $y \to 5000$ as $t \to -\infty$ and $y \to 0$ as $t \to \infty$

36. Solve for x : $3^{2x} = 27^{2x-1}$

The answer is a number:

(A) between 0.5 and 1 (B) between 0 and 0.5 (C) between -0.5 and 0

(D) between 1 and 2 (E) None of these

37. Solve for x: $\log_2(-4 - x) + \log_2(3 - x) = 3$

The solution is a number:

(A) between -9 and -6 (B) between -6 and -4

(C) between -4 and -1 (D) between -1 and 2

(E) between 2 and 5

38. Find the x-intercept of the graph of $y = \ln(x - a) + 2$

(A) $(\ln(-a) + 2, 0)$ (B) $(-2 + \ln a, 0)$ (C) $(e^{-2+\ln(a)}, 0)$

(D) $(e^{-2} + a, 0)$ (E) None of these

39. The number of California gray whales is growing according to the formula $A = Pe^{0.015t}$, where t is measured in years. How long will it take the number of whales to double?

(A) less than 40 years (B) between 40 and 50 years

(C) between 50 and 60 years (D) between 60 and 70 years

(E) more than 70 years

40. Mr. Smart decided to invest $20,000 in a savings account. At what annual percentage rate, compounded monthly, did he invest his money in order to have $36,500 at the end of 10 years?

The interest rate is:

(A) less than 6.1% (B) between 6.1% and 6.3%

(C) between 6.3% and 6.5% (D) between 6.5% and 6.7%

(E) greater than 6.7%

41. The given table lists the day, y, that there were x bacteria (in thousands).

x	1	10	100	1,000	10,000
y	1	3	5	7	9

Find the values of a and b so that $f(x) = a + b\log(x)$ models the data exactly.

(A) $a = 1,\ b = 2$ (B) $a = 2,\ b = 2$ (C) $a = 1,\ b = 1$

(D) $a = 2,\ b = 1$ (E) None of these

42. Which of the following statements is/are TRUE?

(1) $\sum_{k=1}^{50}(15k^2 + 20k) = 5\sum_{k=1}^{50}(3k^2 + 4k)$

(2) $\sum_{i=5}^{40}(7) = 252$

(3) $\sum_{k=1}^{50}(5k^2 - 2) - \sum_{k=1}^{50}(k^2 - 2k) = \sum_{k=1}^{50}(4k^2 + 2k - 2)$

(A) 1 only (B) All of them (C) 1 and 3 only

(D) 1 and 2 only (E) 3 only

43. Evaluate the expression: $\sum_{m=0}^{4}(20 - m!)$

(A) 66 (B) −16 (C) −4 (D) 16 (E) 90

44. Write an expression for the *nth* term of the sequence: $4, 10, 18, 28, 40, \ldots$

(A) $a_n = 2n(n + 1)$ (B) $a_n = n(n + 3)$ (C) $a_n = n(n - 3)$

(D) $a_n = n(n + 1)$ (E) None of these

45. Use sigma notation to write the sum: $\frac{2}{5} + \frac{4}{9} + \frac{6}{13} + \frac{8}{17}$

(A) $\sum_{k=1}^{4} \frac{k+1}{k+4}$ (B) $\sum_{k=1}^{4} \frac{3k-1}{3k+2}$ (C) $\sum_{k=1}^{4} \frac{2^k}{2k+3}$

(D) $\sum_{k=1}^{4} \frac{2k}{4k+1}$ (E) None of these

46. The 5*th* term of an arithmetic sequence is 16 and the 12*th* is 37. Find the common difference.

(A) 3 (B) $\frac{21}{6}$ (C) 7 (D) 21 (E) None of these

47. Determine if the following sequence is arithmetic or geometric:

$$20, -10, 5, -\frac{5}{2}\ldots$$

Find the 8*th* term of the sequence.

(A) $-\frac{5}{16}$ (B) $\frac{5}{32}$ (C) $\frac{33}{2}$ (D) $-\frac{5}{32}$ (E) None of these

48. Find the 12*th* term of the geometric sequence given that the first term is –3 and the second term is 6.

(A) 96 (B) –2048 (C) –96 (D) 6144 (E) None of these

49. Parents decide to set up a college trust fund for their newborn child. The plan is to deposit $100 a month for the next 18 years (i.e. 216 months) in a savings account that pays 6% annual interest compounded monthly. How much money will there be in the account at the end of 18 years? [Round to the nearest dollar]

$$A = 100(1 + \tfrac{0.06}{12})^1 + 100(1 + \tfrac{0.06}{12})^2 + 100(1 + \tfrac{0.06}{12})^3 + \ldots + 100(1 + \tfrac{0.06}{12})^{216}$$

(A) $29,545 (B) $1,888 (C) $38,929 (D) $52,953 (E) None of these

50. Find the sum: $\sum_{k=1}^{\infty} 10\left(\frac{1}{3}\right)^k$.

(A) 5 (B) 7.5 (C) 10 (D) 15 (E) Does not exist