Name: _____ Class: _____ Date: _____ ID: B

ALGEBRA 2 SEMESTER 1 IN CLASS EXAM

Use a graph to find the solution.

_____ 1. You want to set up an aquarium and need to determine what size tank to buy. The graph shows tank sizes using a rule that relates the capacity of the tank to the combined lengths of the fish it can hold. If you want two 2-in. platys, eight 1-in. guppies, and a 3-in. loach, what is the smallest capacity tank you can buy?
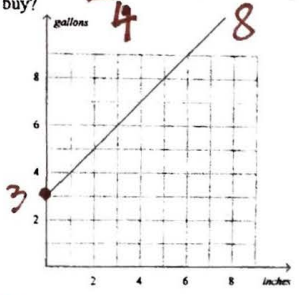
$$y = x + 3$$
$$y = 15 + 3$$
$$y = 18$$

a. 18-gallon   b. 15-gallon   c. 16-gallon   d. 20-gallon

_____ 2. The graph shows the total cost of goldfish at the aquarium shop. Use a table to find out how much 7 goldfish cost.

$$y = x$$

zero →
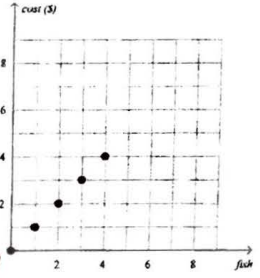
a. $7   b. $1   c. $6   d. $8

Which algebraic expression models the given word phrase?

_____ 3. 2 times the sum of a and b
a. $a + b$ b. $2(a - b)$ c. $2(a + b)$ d. $2a + b$

1

_____ 4. You had $208, but you are spending $5 each day. What algebraic expression models this situation?
a. $208 + 5d$ b. $203d$ c. $208 - 5d$ d. $5 + 208d$
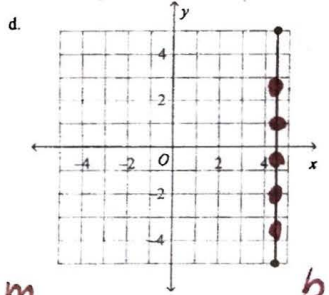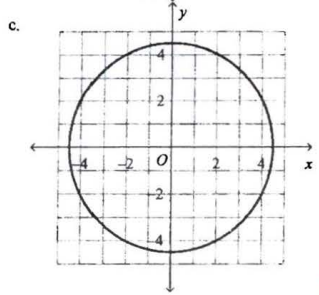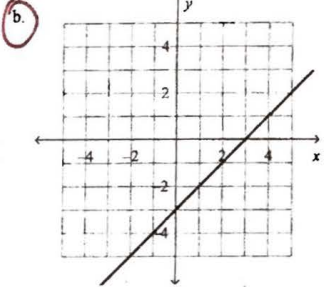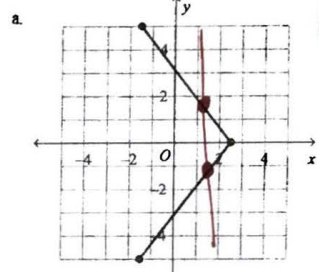
Is the relation a function?

does x repeat?

_____ 5. $\{(14, 5), (11, 4), (5, 10), (2, 14), (11, 1)\}$
a. no   b. yes

_____ 6. Use the vertical-line test to determine which graph represents a function.

a.

b.

c.

d.

m   b

_____ 7. Tickets to a concert are available online for $15 each, plus a one-time handling fee of $1.25. The total cost is a function of the number of tickets bought. What function rule models the cost of the concert tickets (t)? Evaluate the function for 7 tickets.

$$y = 15x + 1.25 = 15 \cdot 7 + 1.25$$

a. $1.25t + 15$; $106.25   b. $15t + 1.25$; $23.75   c. $15t + 1.25$; $106.25   d. $1.25t + 15$; $23.75

What is the slope of the line that passes through the given points?

_____ 8. (12, 1) and (–7, 2)
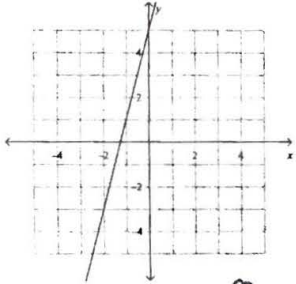a. –19   b. $\frac{1}{19}$ c. $\frac{1}{19}$ d. 19

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 1}{-7 - 12}$$
$$= \frac{1}{-19}$$

2

_____ 9. (−10, −6) and (−10, 4)

a. 10 b. $\frac{1}{10}$ c. undefined d. 0

Handwritten: $\frac{4-(-6)}{-10-(-10)} = \frac{10}{0}$ (vertical)

What is an equation of the line in slope intercept form?

_____ 10.

a. $y = -5x + 4$ b. $y = 5x + 4$ c. $y = 4x + 5$ d. $y = 4x - 5$

Write the equation in slope-intercept form. What are the slope and y-intercept?
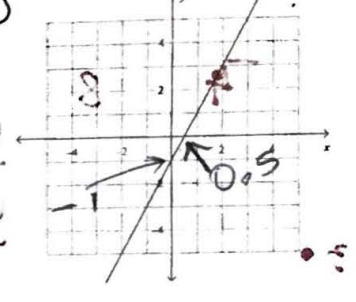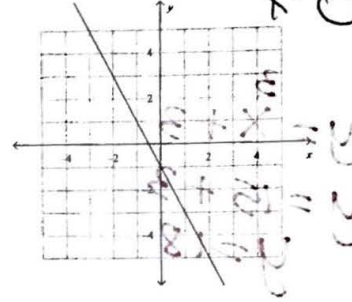
_____ 11. $-4x - 6y = 7$

a. $y = \frac{2}{3}x - \frac{7}{6}$;
   slope: $\frac{2}{3}$; y-intercept: $-\frac{7}{6}$

c. $y = -\frac{2}{3}x + \frac{7}{6}$;
   slope: $\frac{2}{3}$; y-intercept: $\frac{7}{6}$

b. $y = \frac{2}{3}x + \frac{7}{6}$;
   slope: $\frac{7}{6}$; y-intercept: $\frac{2}{3}$

d. $y = -\frac{2}{3}x - \frac{7}{6}$;
   slope: $-\frac{2}{3}$; y-intercept: $-\frac{7}{6}$

Handwritten:
$-4x - 6y = 7$
$-6y = 4x + 7$
$\frac{-6y}{-6} = \frac{4x}{-6} + \frac{7}{-6}$
$y = -\frac{2}{3}x - \frac{7}{6}$

What is the graph of the equation?

_____ 12. $2x - y = 1$

a.

Handwritten: x-int $x = 0.5$ y-int $y = -1$

b.
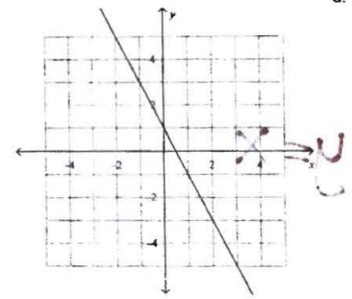
d.

Write an equation of the line, in point-slope form, that passes through the two given points.

_____ 13. points: $(-11, 14), (5, -18)$

a. $y - 14 = -2(x + 11)$ b. $y - 11 = -\frac{1}{2}(x + 14)$ c. $y - 14 = -\frac{1}{2}(x + 11)$ d. $y - 11 = -2(x - 14)$

Handwritten:
$m = \frac{-18 - 14}{5 - (-11)} = \frac{-32}{16} = -2$

$y - y_1 = m(x - x_1)$

3   4

$$Ax + By = C$$

What is the equation of the given line in standard form? Use integer coefficients.

____ 14. $y = \frac{3}{5}x - 10$

$$-\frac{3}{5}X + y = -10 \qquad -3x + 5y = -50$$

a. $3x + 5y = -50$ (b.) $-3x + 5y = -50$ c. $-3x + 5y = -10$ d. $-3x - 5y = -50$

____ 15. $y = -9.1x + 10.9$
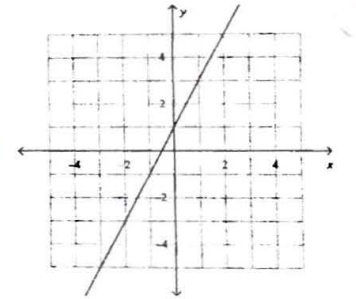
$$9.1X + y = 10.9 \qquad 91X + 10y = 109$$

a. $91x + 10y = -109$ b. $-91x + 10y = 109$ c. $-91x + 10y = -109$ (d.) $91x + 10y = 109$

What are the intercepts of the equation? Graph the equation.

____ 16. $-6x + 4y = -24$

$$y\,int = -6 \qquad X = 4$$

a. x-intercept: (4, 0)
y-intercept: (0, -6)
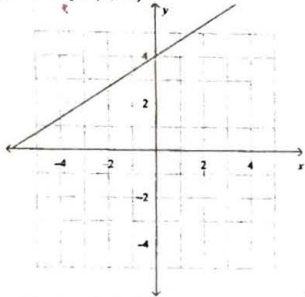
c. x-intercept: (-6, 0)
y-intercept: (0, 4)
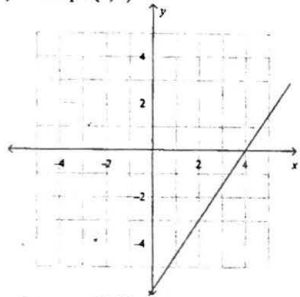
b. x-intercept: (-6, 0)
y-intercept: (0, 4)
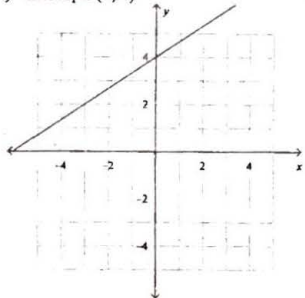
(d.) x-intercept: (4, 0)
y-intercept: (0, -6)
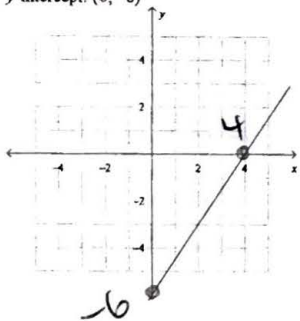
____ 17. You are trying to compare the Fahrenheit and Celsius scales and you have two examples: Temperature A is 40 degrees Celsius and 104 degrees Fahrenheit. Temperature B is 60 degrees Celsius and 140 degrees Fahrenheit. What graph models the relationship between the Fahrenheit and Celsius scales? What is an equation of the line in slope-intercept form?

a.

$$y = \frac{5}{9}x + 32$$

c.

$$y = \frac{9}{5}x + 32$$

b.

$$y = \frac{5}{9}x + 32$$

(d.)

$$y = \frac{9}{5}x + 32$$

5

6

y-int (handwritten)
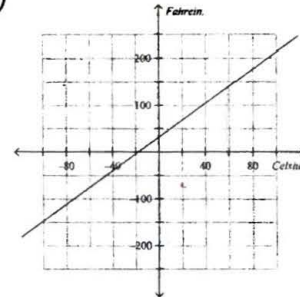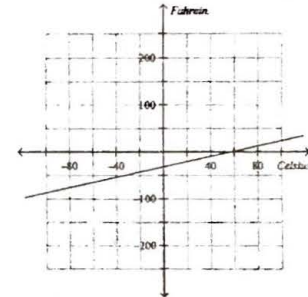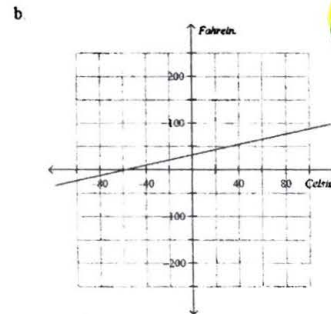
___ 18. The office manager of a small office ordered 155 packs of printer paper. Based on average daily use, she knows that the paper will last about 45 days. What graph represents this situation? How many packs of printer paper should the manager expect to have after 5 days?

a. (circled)

x-int c. (handwritten)

paper

150

100

50

20   40   60   days

137.8 packs

b. (crossed out)

paper

150

100

50

20   40   60   days

137.8 packs

c. (crossed out)

paper

150

100

50

20   40   60   days

17.2 packs

d. (crossed out)

paper

150

100

50

20   40   60   days

17.2 packs

(handwritten right side)
y-int 155 (0,155)
x-int 45
(45,0)
$\dfrac{155}{-45}X + 155$

What is the equation of the line in slope-intercept form?

___ 19. the line parallel to $y = 6x - 8$ through (7, 2)

a. $y = -6x - 40$ b. $y = 6x - 44$ c. $y = -\dfrac{1}{6}x - 40$ **d.** $y = 6x - 40$ (circled)

(handwritten)
parallel = equal slopes
m = 6   (7, 2)
        x   y
y = mx + b?
2 = 6·7 + b
-42
b = -40

___ 20. the line perpendicular to $y = \dfrac{1}{4}x + 7$ through (5, 8)

a. $y = -4x + 28$ (circled)   b. $y = 4x + 28$ (crossed)   c. $y = -\dfrac{1}{4}x + 28$ d. $y = \dfrac{1}{4}x + 28$

(handwritten)
m = -4
opposite/reciprocal
(5, 8)
  x y
y = mx + b
8 = -4·5 + b
+20
b = 28 (circled)

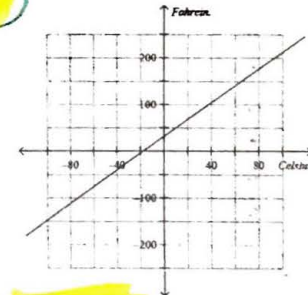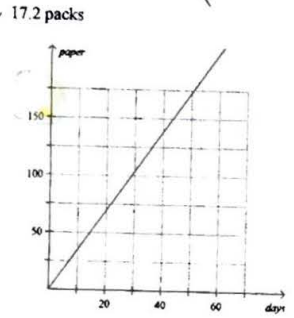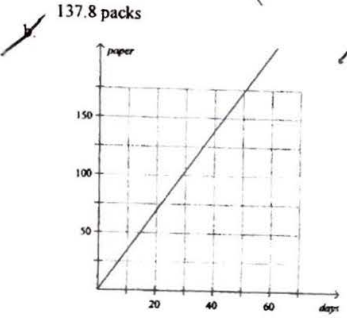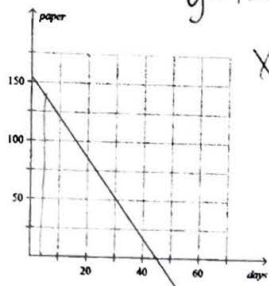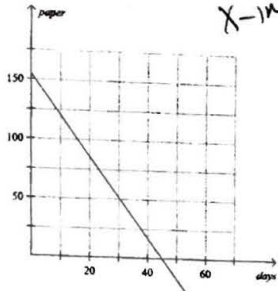___ 21. A nationwide club begins a chapter near you. You research the membership of the club over the past few decades. The table shows your data. What is the equation for a line of best fit? How many members would you expect there to be in the year 2019?

Year	1980	1985	1990	1995	2000	2005
Membership	5,300	6,900	8,100	10,100	11,200	13,500

a. $y = 5,300x + 309.92$; 17,387   b. $y = 309.92x + 5,300$; 27,587   c. $y = 5,300x + 309.92$; 27,587

d. $y = 309.92x + 5,300$; 17,387 (circled)

22. How are the functions $y = x$ and $y = x - 5$ related? How are their graphs related?

a. (circled) Each output for $y = x - 5$ is 5 less than the corresponding output for $y = x$.
The graph of $y = x - 5$ is the graph of $y = x$ translated down 5 units.

b. Each output for $y = x - 5$ is 5 less than the corresponding output for $y = x$.
The graph of $y = x - 5$ is the graph of $y = x$ translated up 5 units.

c. Each output for $y = x - 5$ is 5 more than the corresponding output for $y = x$.
The graph of $y = x - 5$ is the graph of $y = x$ translated down 5 units.

d. Each output for $y = x - 5$ is 5 more than the corresponding output for $y = x$.
The graph of $y = x - 5$ is the graph of $y = x$ translated up 5 units.

___ 23. If a function, $f(x)$ is shifted to the left nine unit(s), what function represents the transformation?

a. $f(x) - 9$ **b.** $f(x + 9)$ (circled)   c. $f(x) + 9$ d. $f(x - 9)$

(handwritten)
L, R   U, D
(inside)   (outside)
change sign!

What is the equation of the absolute value function?

___ 24.

(graph with arrow)
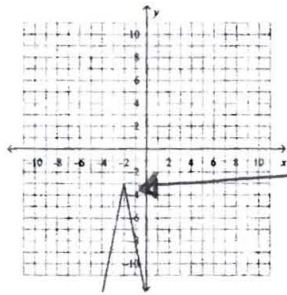
(handwritten)
(-2, -3)
  L   D

a. $y = -5|x - 2| + 3$ b. $y = -5|x - 2| - 3$ c. $y = 5|x + 2| - 3$ **d.** $y = -5|x + 2| - 3$ (circled)

8

Assume that x and y are whole numbers. Use a table to solve the system of inequalities.

25. $\begin{cases} x + y > 1 \\ 2x + 3y \le 7 \end{cases}$

a. (0, 1) (0, 2) (1, 1) (2, 1) b. (0, 2) (1, 1) (2, 1) c. (0, 2) (1, 1) d. (0, 1) (0, 2) (1, 1)

26. $\begin{cases} x + y \ge 7 \\ 3x + 3y \le 21 \end{cases}$ $3x+3y \ge 21$ $3x+3y \le 21$ $3x+3y=21$

a. all x and y values for which $x = y + 7$ b. all x and y values for which $y = -x - 7$ c. all x and y values for which $y = x - 7$ d. all x and y values for which $y = -x + 7$

$x+y=7$

$y=-x+7$

27. Your furniture store sells two types of dining room tables. The first, type A, costs \$223 and you make a \$22 profit on each one. The second, type B, costs \$150 and you make a \$19 profit on each one. You can order no more than 70 tables this month, and you need to make at least \$1450 profit on them. If you must order at least one of each type of table, how many of each type of table should you order if you want to minimize your cost?

a. 30 of type A / 40 of type B   (19 of type A / 51 of type B)
b. 40 of type A / 30 of type B   d. 51 of type A / 19 of type B

handwritten: type A COST 22B — (22)x 201X type B 150 — 19 y 131 y X+y ≤ 70 22x + 19y ≥ 1450

28. What is element a_{23} in matrix A?

$A = \begin{bmatrix} -8 & -7 & 8 \\ 4 & 1 & -5 \\ 9 & 9 & 7 \end{bmatrix}$

a. 4 b. 9 c. -7 d. -5

handwritten: $a_{2\,3}$ ROW column

How can you represent the system of equations with a matrix?

29. $\begin{cases} -4x - 4y + 6z = 7 \\ 8x - 7y - 12z = 14 \\ 12x + 8y + 6z = -8 \end{cases}$

a. $\begin{bmatrix} -4 & -4 & 2 & -7 \\ 8 & -7 & -12 & -14 \\ 12 & 8 & 6 & -8 \end{bmatrix}$ b. $\begin{bmatrix} -4 & -4 & 6 & 7 \\ 8 & -7 & -12 & 14 \\ 12 & 8 & 6 & -8 \end{bmatrix}$ c. $\begin{bmatrix} 12 & 8 & -4 \\ 8 & -7 & -4 \\ 6 & -12 & 2 \\ -8 & -14 & -7 \end{bmatrix}$ d. $\begin{bmatrix} 12 & 8 & -4 \\ 8 & -7 & -4 \\ 6 & -12 & 2 \\ -8 & 14 & 7 \end{bmatrix}$

What is the solution of the system?

30. $\begin{cases} -2x - 7y = -37 \\ 8x - 2y = -2 \end{cases}$

handwritten: $-2 \cdot 5 - 7 \cdot 1 \ne -37$ $-2 \cdot 1 - 7 \cdot 5 = -37 ✓$

$-8x - 28y = -148$ $8x - 2y = -2$ $-30y = -150$ $y = 5$

a. (5, 1) b. (1, 5) c. (-1, -5) d. (-1, 5)

What is the solution of the system of equations? (Use a calculator.)

31. $\begin{cases} 2x - 5y + 3z = -15 \\ -4x - 3y + z = -3 \\ -3x + 3y + 4z = 5 \end{cases}$

handwritten: 3×4 $\begin{vmatrix} 2 & -5 & 3 & -15 \\ -4 & -3 & 1 & -3 \\ -3 & 3 & 4 & 5 \end{vmatrix}$ RREF MAT A

a. (1, -2, 1) b. (1, -2, 1) c. (-1, 2, -1) d. (-1, 2, -1)

32. Which is the graph of $y = -3(x + 3)^2 + 3$?

handwritten: vertex, (-3, 3)

a. b. c. d.

9

10
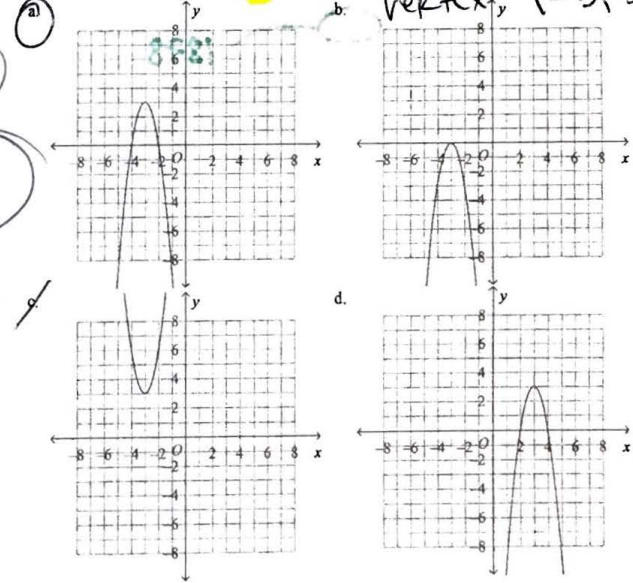
33. A biologist took a count of the number of migrating waterfowl at a particular lake, and recounted the lake's population of waterfowl on each of the next six weeks.

Week	0	1	2	3	4	5	6
Population	595	600	659	772	939	1,160	1,435

Find a quadratic function that models the data as a function of x, the number of weeks. Use the model to estimate the number of waterfowl at the lake on week 8.

a. $P(x) = 27x^2 - 22x + 595; 2,147$ waterfowl   b. $P(x) = 27x^2 - 22x + 595; 1,764$ waterfowl
c. $P(x) = 32x^2 + 22x + 545; 2,769$ waterfowl   d. $P(x) = 32x^2 + 22x + 545; 2,267$ waterfowl

34. A historian took a count of the number of people in a Gold Rush town for six years in the 1870's.

Year	1870	1871	1872	1873	1874	1875	1876
Population	425	442	449	446	433	410	377

Find a quadratic function that models the data as a function of x, the number of years since 1870. Use the model to estimate the number of people in the town in 1888.

a. $P(x) = -5x^2 + 22x + 425; 334$ people   b. $P(x) = -x^2 - 22x + 375; 135$ people
c. $P(x) = -x^2 - 22x + 375; 172$ people   d. $P(x) = -5x^2 + 22x + 425; 281$ people

35. The table shows a meteorologist's predicted temperatures for an April day in Washington D.C. Use quadratic regression to find a quadratic model for this data. (Use the 24-hour clock to represent times after noon.)

Time	Predicted Temperature (°F)
8 A.M.	50.48
10 A.M.	61.8
12 P.M.	68.98
2 P.M.	72.03
4 P.M.	70.94
6 P.M.	65.71

a. $-1.017x^2 + 13.965x - 32.153$ b. $-0.017x^2 + 15.965x - 40.153$ c. $-0.517x^2 + 14.965x - 36.153$
d. $-0.517x^2 - 14.965x + 36.153$

36. The table shows a meteorologist's predicted temperatures for an April day in Washington D.C starting at 8 A.M. Use a quadratic model of this data to predict the high temperature for the day. At what time does the high temperature occur?

Time	Predicted Temperature (°F)
8 A.M.	46.97
10 A.M.	58.06
12 P.M.	65.26
2 P.M.	68.57
4 P.M.	67.99
6 P.M.	63.52

a. The predicted high temperature is 68.81 degrees Fahrenheit occurring at 2:42 P.M.   b. The predicted high temperature is 77.81 degrees Fahrenheit occurring at 3:42 P.M.   c. The predicted high temperature is 68.81 degrees Fahrenheit occurring at 3:42 P.M.   d. The predicted high temperature is 77.81 degrees Fahrenheit occurring at 2:42 P.M.

What is the number of real solutions?

37. $3x^2 - x + 7 = 0$

a. two solutions   b. no real solutions   c. one solution   d. cannot be determined

38. $6x^2 + 6 = -12x$

a. two solutions   b. one solution   c. no real solutions   d. cannot be determined

39. During a manufacturing process, a metal part in a machine is exposed to varying temperature conditions. The manufacturer of the machine recommends that the temperature of the machine part remain below 133°F. The temperature T in degrees Fahrenheit x minutes after the machine is put into operation is modeled by $T = -0.005x^2 + 0.45x + 125$. Will the temperature of the part ever reach or exceed 133°F? Use the discriminant of a quadratic equation to decide.

a. yes   b. no

Consider the leading term of each polynomial function. What is the end behavior of the graph?

40. $5x^3 + 2x$

a. The leading term is $5x^3$. Since n is odd and a is positive, the end behavior is up and up.   b. The leading term is $5x^3$. Since n is odd and a is positive, the end behavior is down and down.   c. The leading term is $5x^3$. Since n is odd and a is positive, the end behavior is up and down.   d. The leading term is $5x^3$. Since n is odd and a is positive, the end behavior is down and up.
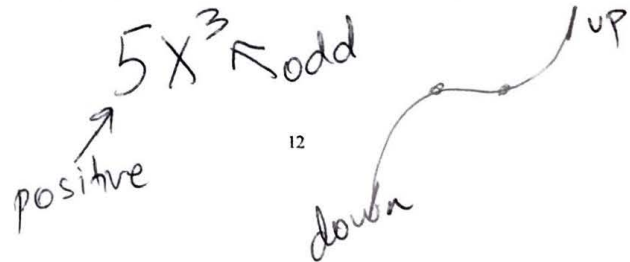
What is the degree of the polynomial that generates the given data?

___ 41.

x	–6	–2	0	2	6
y	642	46	0	–6	–282

a) cubic model   b. quadratic model   c. linear model   d. none of these

___ 42.   What is a cubic polynomial function in standard form with zeros –4, –3, and –2?

$(x+4)(x+3)(x+2)$

a. $f(x) = x^3 - 9x^2 + 26x + 12$ b. $f(x) = x^3 - 9x^2 - 26x + 24$ c. $f(x) = x^3 + 9x^2 + 26x + 24$
d. $f(x) = x^3 - 9x^2 + 5x + 24$

$(-4,0)$
$(-3,0)$
$(-2,0)$

What are the zeros of the function? What are their multiplicities?

___ 43. $f(x) = x^4 + 7x^3 + 12x^2$

$x^2(x^2 + 7x + 12) = x^2(x+3)(x+4)$

$-3, -4$

a. the numbers 0 and –3 are zeros of multiplicity 2; the number –4 is a zero of multiplicity 1   b. the numbers 3 and 4 are zeros of multiplicity 2; the number 0 is a zero of multiplicity 1   c. the number 0 is a zero of multiplicity 2; the numbers –3 and –4 are zeros of multiplicity 1   d. the number 0 is a zero of multiplicity 2; the numbers 3 and 4 are zeros of multiplicity 1

O F M 2

___ 44.   Determine which binomial is not a factor of $4x^4 - 21x^3 - 46x^2 + 219x + 180$.
a. $x + 4$ b. $x + 3$ c. $x - 5$ d. $4x + 3$

$-3, -0.75, 4, 5$

$-3, -0.75, 4, 5$

___ 45.   The polynomial $x^3 + 0x^2 - 37x - 84$ expresses the volume, in cubic inches, of a shipping box, and the width is $(x + 3)$ in. If the width of the box is 15 in., what are the other two dimensions? (*Hint*: The height is greater than the depth.)

a. height: 16 in.   depth: 5 in.
b. height: 14 in.   depth: 5 in.
c. height: 16 in.   depth: 7 in.
d. height: 14 in.   depth: 7 in.

$x+3=15$
$x=12$

$(4x+3)$

$-3 | 1 \quad 0 \quad -37 \quad -84$
$\quad\quad \downarrow \quad -3 \quad 9 \quad 84$
$\quad 1 \quad -3 \quad -28 \quad (0)$ R

$x^2 - 3x - 28$
$(x - 7)(x + 4)$
h 16
d 5

What is the simplest form of the expression?

___ 46. $\sqrt{245} + \sqrt{45} - \sqrt{5}$
a. $9\sqrt{5}$ b. $58\sqrt{5}$ c. $10\sqrt{5}$ d. $21\sqrt{5}$

___ 47. $\sqrt[3]{108} + \sqrt[3]{1372} - \sqrt[3]{500}$
a. $15\sqrt[3]{4}$ b. $5\sqrt[3]{4}$ c. $4.2\sqrt[3]{4}$ d. $16\sqrt[3]{4}$

245 | 5
(49)

$7\sqrt{5} + 3\sqrt{5} - \sqrt{5}$
$(9\sqrt{5})$

108 | 2
54 | 2
(27)

1372 | 2
686 | 2
(343)

500 | 4
(125)

___ 48.   What is $\dfrac{\sqrt[3]{x^5}}{\sqrt[4]{x^2}}$ in simplest form?

a. $x^{\frac{17}{12}}$ b. $x^{\frac{24}{34}}$ c. $x^{\frac{34}{24}}$ d. $x^{\frac{12}{17}}$

What is the simplest form of the number?

___ 49. $49^{-1.5}$
a. –47.5   b. $\dfrac{1}{343}$ c. –73.5   d. $\dfrac{1}{505}$

___ 50.   You can model the population of a certain city between the years 1960 and 2005 by the radical function $P(x) = 70000\sqrt[3]{x - 1940}$. Using this model, in what year was the population of that city 260,000?
a. 1991   b. 1989   c. 1998   d. 1984

$\dfrac{260,000}{70,000} = 70000 \sqrt[3]{x - 1940}$

$\left(\dfrac{26}{7}\right)^3 = \sqrt[3]{x - 1940}^{\,3}$

$51.24 = x - 1940$
$+1940 \qquad +1940$
$1991 = x$

$X^{\frac{5}{3}} = X^{\frac{5}{3} - \frac{1}{4}} = X^{\frac{17}{12}}$

$X^{\frac{2}{8}} \leftarrow \frac{1}{4}$

$49^{-1.5} = 49^{-\frac{3}{2}} = \dfrac{1}{49^{\frac{3}{2}}}$
$= \dfrac{1}{\sqrt{49}^3}$
$= \dfrac{1}{7^3}$
$= \dfrac{1}{343}$

$\sqrt[3]{108} + \sqrt[3]{1372} - \sqrt[3]{500}$
$\sqrt[3]{27 \cdot 4} + \sqrt[3]{343 \cdot 4} - \sqrt[3]{125 \cdot 4}$
$3\sqrt[3]{4} + 7\sqrt[3]{4} - 5\sqrt[3]{4}$
$5\sqrt[3]{4}$