1. Let $A = \sqrt[3]{125}$, $B = \sqrt{25}$, and $C = \sqrt[4]{625}$. For which of the following is the relationship true?

    I. $A > B$

    II. $B < C$

    III. $B = C$

  A. I only   B. II only

  C. I and II   D. III only

2. Which of the following, when simplified, results in an irrational number?

  A. $(\sqrt{2} + \sqrt{3})(\sqrt{2} - \sqrt{3})$

  B. $\dfrac{\sqrt{8}}{\sqrt{2}}$

  C. $(\sqrt{2} + \sqrt{3})^2$

  D. $\dfrac{\sqrt{3} + 2\sqrt{3}}{\sqrt{3}}$

3. Express in simplest form:

  a) $\sqrt{60} - 6\sqrt{\dfrac{5}{3}}$

  b) $\dfrac{2\sqrt{3} + 3\sqrt{2}}{\sqrt{8} - \sqrt{12}}$

  c) $\sqrt{\dfrac{25x^5}{y^3}}$

4. The following steps prove that the product of two rational numbers is rational. These steps are not necessarily in correct order.

  1) $\left(\dfrac{a}{b}\right)\left(\dfrac{c}{d}\right) = P$

  2) let $r = \dfrac{a}{b}$ and $s = \dfrac{c}{d}$, where a, b, c, and d are integers; b and $d \neq 0$

  3) $\dfrac{ac}{bd} = P$

  4) $\dfrac{e}{f} = P$

  5) let $ac = e$ and $bd = f$, where e and f are integers

  6) $rs = \dfrac{e}{f}$

  7) $rs = P$

What is the correct order of these steps?

  A. 1, 2, 3, 4, 5, 7, 6   B. 2, 1, 3, 5, 4, 6, 7

  C. 7, 1, 2, 3, 4, 6, 5   D. 7, 2, 1, 3, 5, 4, 6

5. Simplify:

$$\sqrt{-25} - 4\sqrt{-9}$$
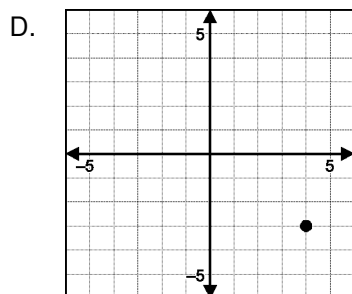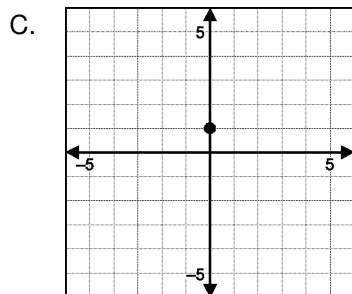
  A. 0   B. $-7i$ C. $7i$ D. $17i$
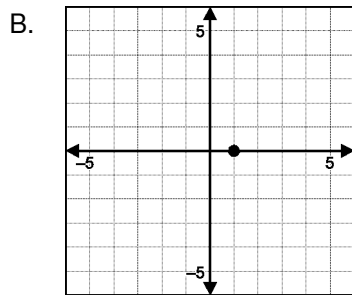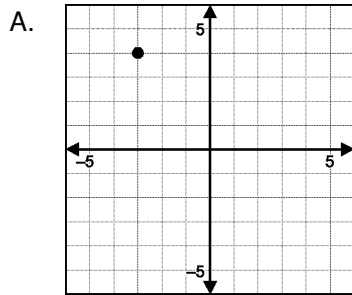
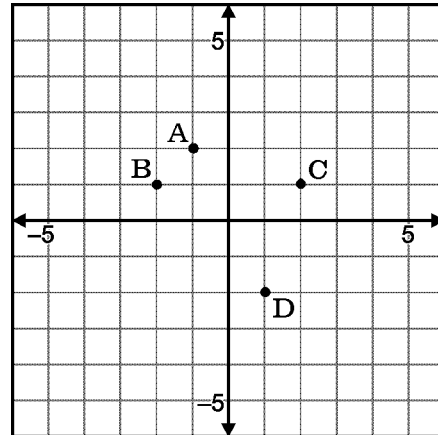6. Find the product of the two complex numbers:

$$(3 + 2i)(2 - 7i)$$

7. Find the roots of $x^2 + 4x + 6 = 0$

  A. $2 \pm i\sqrt{2}$ B. $4 \pm i\sqrt{2}$

  C. $-2 \pm i\sqrt{2}$ D. $2 \pm 2i\sqrt{2}$

8. Which of the following graphs represents the number $i(4 + 3i)$ in the complex plane?

A.

B.

C.

D.

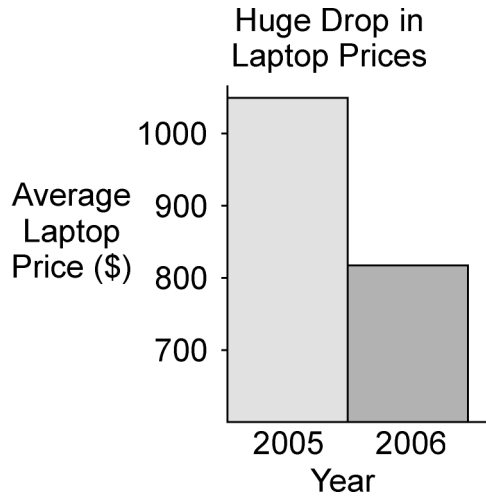9. Which point shows the location of $-2 + i$ on the complex plane?

A. A   B. B   C. C   D. D

10. A, B, C and D are the vertices of a parallelogram on the complex plane. If A represents $0 + 0i$, B represents $5 + i$, and D represents $2 + 7i$, what complex number does C represent?

A. $7 + 8i$ B. $-2 + 6i$

C. $7 - 8i$ D. $2 - 6i$

11.

Huge Drop in Laptop Prices

Average Laptop Price ($) — Year (2005, 2006)

What is misleading about the graph?

A. Laptop prices seem to have tripled.

B. Laptop prices seem to have doubled.

C. Laptop prices seem to have been reduced in half.

D. Laptop prices seem to have remained the same.

12. The pictograph compares company profits between 2007 and 2008. If the area of the two pictures is compared, instead of the height, then how many times greater are profits in 2008 than in 2007?

Company Profits
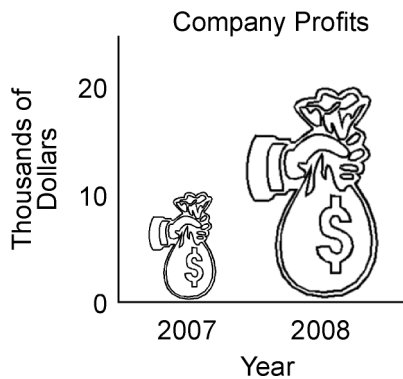
A. 3 times   B. 4 times

C. 5 times   D. 8 times

13. Select the reason(s) why the graph is misleading.

    I. there is no title

    II. the 3-D effect causes a distortion

    III. some of the segments appear to be the wrong size

Jolt 15%, Snapple 15%, Coke 35%, Pepsi 35%

Type of Soft Drinks
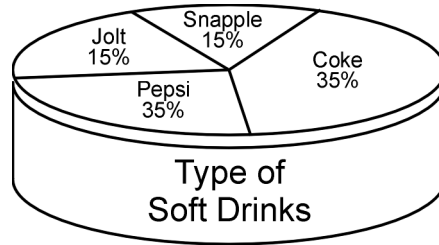
A. I only   B. III only

C. I and II only   D. I, II and III

14. The graph shows how a dollar in 2012 was worth less than a dollar in 1992.

1992 Value $1.00

2002 Value $0.82

2012 Value $0.67
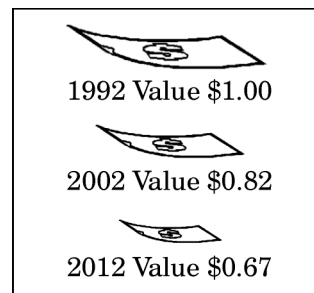
There's another period when the value of the dollar fell even faster: 1970 to 1990. During those two decades, the dollar lost nearly 75% of its value. Illustrate the decline in value with a picture of a 1970-dollar bill and a 1990-dollar bill, such that their areas are in a ratio of 4 : 1.

15.

House Sales for 2012
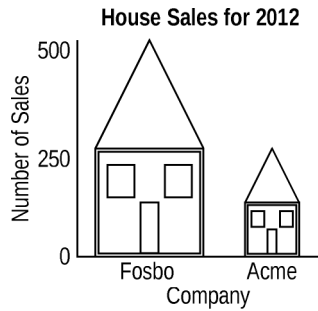
a) What impression does the graph seem to convey?

b) Why does the graph give the impression that it does?

c) Draw a rectangle with a height of 4 cm and a width of 2 cm and let it represent the number of houses sold by the Fosbo company. What is the area of the rectangle?

d) Draw a second rectangle, on a proper scale, so that its *area* represent sales of the Acme company.

e) On a proper scale, how much smaller is the rectangle representing the Fosbo company than the Acme company?

16. Refer to the diagram to find the component form of **a** + **b** + **d**.
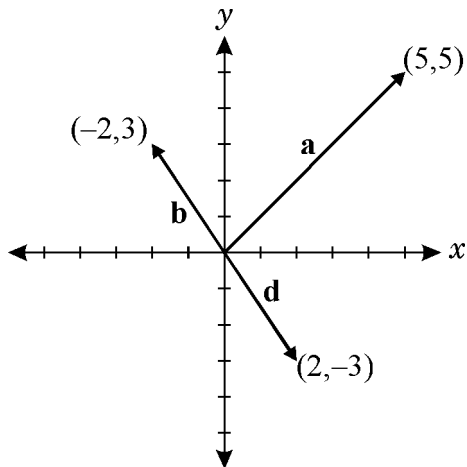
A. ⟨9, 11⟩   B. ⟨5, 5⟩

C. ⟨3, 8⟩   D. ⟨4, 4⟩

17. A tree trunk is pulled with a force of 3200 pounds by a truck's cable that makes an angle of 25° with the horizontal. What is the vertical component of the force correct to the nearest pound?
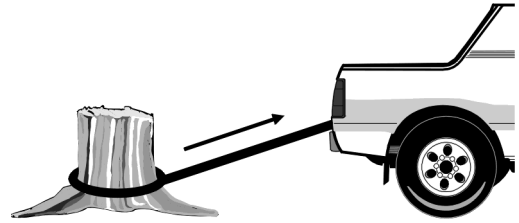
A. 1352   B. 1423   C. 1978   D. 2900

18. Forces of 30 N to the right and 20 N downward are acting on the same object. Find the magnitude and direction of the resultant.

A. 36.1 N 56° below the 30 N force

B. 36.1 N 56° above the 30 N force

C. 36.1 N 34° below the 30 N force

D. 10.1 N 34° below the 30 N force

19. The Heavenly Shoe Store's inventory of shoes is:

> *Men's Shoes*: 79 Dress, 159 Running, 119 Boots, 199 Walking

> *Women's Shoes*: 199 Boots, 319 Dress, 39 Running, 119 Walking

The South Side Shoe Store's inventory of shoes is:

> *Men's Shoes*: 387 Dress, 232 Boots, 309 Running, 232 Walking

> *Women's Shoes*: 0 Running, 309 Boots, 154 Dress, 309 Walking

The two companies decide to merge. What is a matrix that represents the total inventory of the newly amalgamated company?

A. $\begin{bmatrix} 79 & 159 & 119 & 199 \\ 319 & 39 & 199 & 119 \end{bmatrix}$

B. $\begin{bmatrix} 387 & 309 & 232 & 232 \\ 154 & 0 & 309 & 309 \end{bmatrix}$

C. $\begin{bmatrix} 466 & 468 & 351 & 431 \\ 473 & 39 & 508 & 428 \end{bmatrix}$

D. $\begin{bmatrix} 79 & 39 & 119 & 199 \\ 319 & 159 & 199 & 119 \end{bmatrix}$

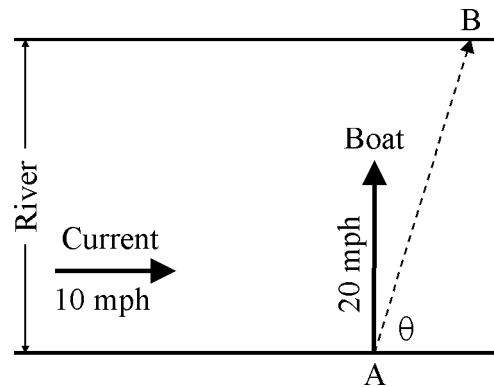20. Solve for y: $\begin{vmatrix} 2 & 1 & 1 \\ 5 & -1 & 1 \\ 4 & y & 1 \end{vmatrix} = 16$

21. Triangle *JKL* was transformed using the following matrix calculation:

$$\begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}\begin{bmatrix} 1 & 2 & -3 \\ -5 & 4 & 5 \end{bmatrix} + \begin{bmatrix} 4 & 0 \\ 0 & -4 \end{bmatrix}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

What are the coordinates for *L'*?

A. $(-2, 6)$ B. $(2, -6)$

C. $(6, -2)$ D. $(-6, 2)$

22. A boat crosses the river at a velocity of 20 miles per hour.

If the river has a current of 10 miles per hour as shown, what is the actual velocity of the boat?

A. 18.0   B. 18.6   C. 22.4   D. 26.2

23. The diagram below represents a plane flying in a northeast direction at a velocity of 500 miles per hour. The wind is blowing from north to south at a velocity of 30 miles per hour. Find the velocity of the plane rounded to the nearest tenth of a mile per hour?
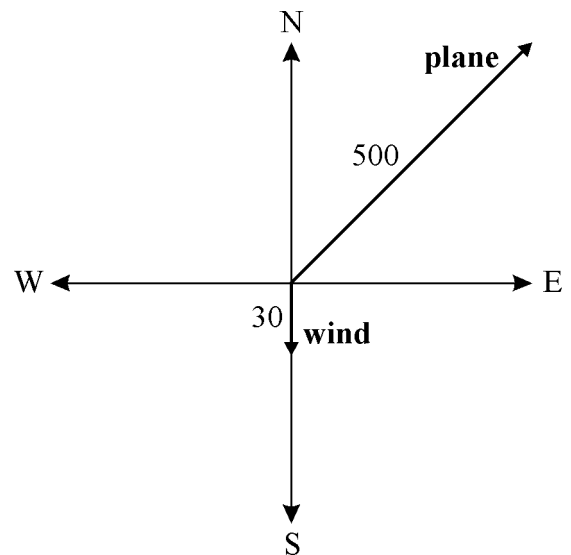
A. 469.3   B. 479.3

C. 481.5   D. 485.1

24. The Shell Phone company produces three different types of cell phones at two different locations. The total output of cell phones in the two locations for the months of January and February is given in the tables.

January

	Model A	Model B	Model C
Location I	35	35	40
Location II	45	15	40

February

	Model A	Model B	Model C
Location I	40	35	30
Location II	10	10	5

The cost to produce each model of cell phone and the selling prices are given in the tables.

Production Costs

Model A	25
Model B	40
Model C	10

Selling Price

Model A	75
Model B	120
Model C	30

If matrix A is a 2×3 representing the January production, matrix B is a 2×3 matrix representing the February production, matrix C is a 3×1 matrix representing the production costs and matrix D is a 3×1 matrix representing the selling price, what does the matrix $(A + B)(D - C)$ represent?

A.   The total profit for the month of February at each location.
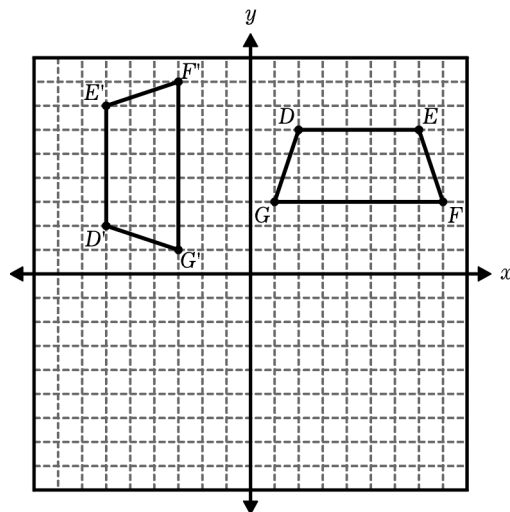
B.   The total revenue from sales for the month of January at each location.

C.   The total revenue from sales for the month of February at each location.

D.   The total profit at each location.

25. Which graph represents the transformation matrix $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 2 & 7 & 8 & 1 \\ 6 & 6 & 3 & 3 \end{bmatrix}$?

A.
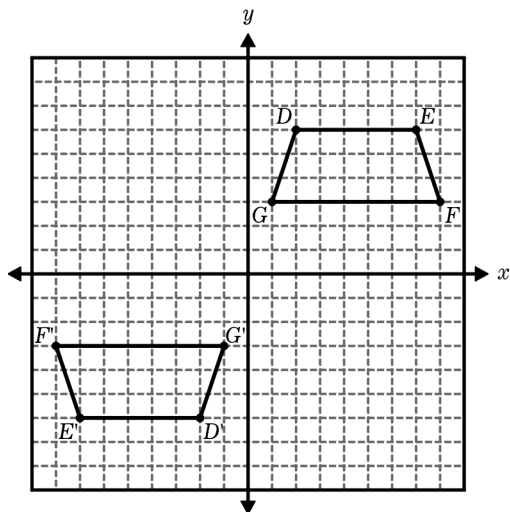
B.

C.
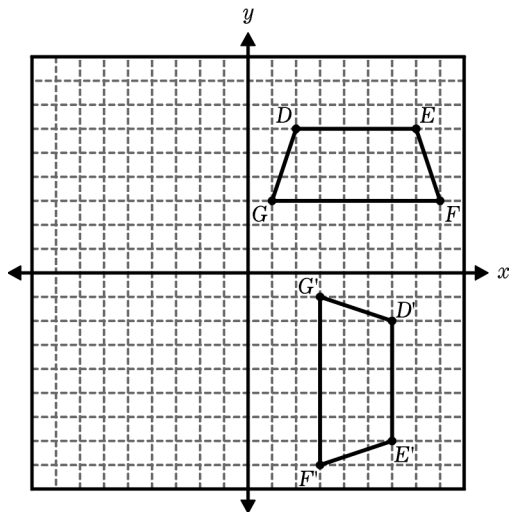
D.
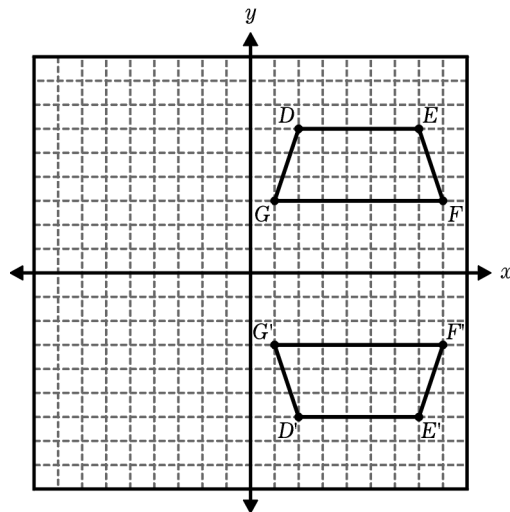
26. Stephanie and Kristina's stock holding are given in the table below.

	IBM	TI	MS	NT
Stephanie	355	266	355	0
Kristina	355	355	355	266

At the close of trade on a certain day, the prices (in dollars per share) of the stocks are $25 for IBM, $15 for TI, $48 for MS, and $16 for NT.

The data could be summarized using the following matrices:

$$M = \begin{bmatrix} 355 & 266 & 355 & 0 \\ 355 & 355 & 355 & 266 \end{bmatrix} \qquad B = \begin{bmatrix} 25 \\ 15 \\ 48 \\ 16 \end{bmatrix}$$

What is the entry in row 2 column 1 of the matrix product MB?

A. 29905   B. 35496   C. 27857   D. 28560

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Number and Quantity

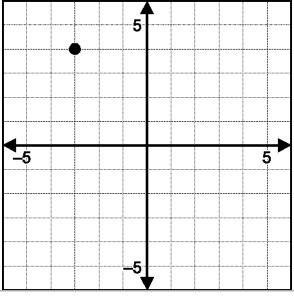| Num	Scoring	Standard	Answer
1	D	N.RN.01	III only
2	C	N.RN.02	$(\sqrt{2} + \sqrt{3})^2$
3		N.RN.02	$0;\ \dfrac{-5\sqrt{6}}{2} - 6;\ \dfrac{5x^2\sqrt{x}}{y\sqrt{y}}$
4	D	N.RN.03	7, 2, 1, 3, 5, 4, 6
5	B	N.CN.02	$-7i$
6		N.CN.02	$20 - 17i$
7	C	N.CN.07	$-2 \pm i\sqrt{2}$
8	A	N.CN.05	
9	B	N.CN.04	B
10	A	N.CN.06	$7 + 8i$
11	C	N.Q.01	Laptop prices seem to have been reduced in half.
12	B	N.Q.01	4 times
13	C	N.Q.01	I and II only
14		N.Q.01	[picture]
15		N.Q.01	The houses' relative areas imply about a 75% drop in value; [pictures]; half as large.
16	B	N.VM.04A	$\langle 5, 5 \rangle$
17	A	N.VM.03	1352
18	C	N.VM.04B	36.1 N 34° below the 30 N force
19	C	N.VM.08	$\begin{bmatrix} 466 & 468 & 351 & 431 \\ 473 & 39 & 508 & 428 \end{bmatrix}$
20		N.VM.12	5
21	A	N.VM.12	$(-2, 6)$
22	C	N.VM.03	22.4
23	B	N.VM.03	479.3
24	D	N.VM.08	The total profit at each location.

25	A	N.VM.12
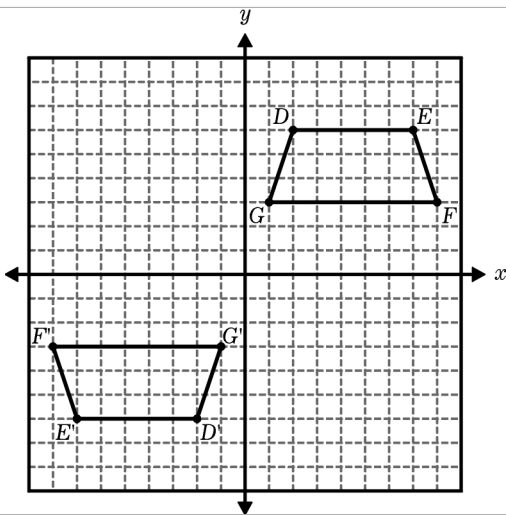
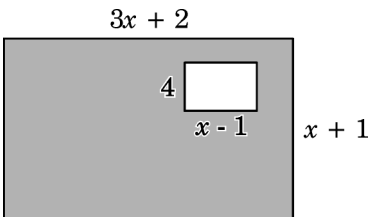| 26	B	N.VM.08	35496

1. Simplify: $(3a^2b - 6ab^2) - (5 + 7ab^2 - 3a^2b)$

   Ⓐ $-13ab^2 - 5$ Ⓑ $3ab^2 - 5$

   Ⓒ $6a^2b - 13ab^2 - 5$ Ⓓ $6a^2b + ab^2 - 5$

2. Simplify:
   $\left(-4nk + 3k^2\right) - \left[\left(nk - 3k^2\right) + \left(k^2 - nk\right)\right]$

   Ⓐ $-6nk + 7k^2$ Ⓑ $-4nk + k^2$

   Ⓒ $5k^2 - 4nk$ Ⓓ $4nk - kk^2$

3. Find the area of the shaded region in terms of x.

   $3x + 2$

   4

   $x - 1$ $x + 1$

   Ⓐ $x^2 + x + 2$ Ⓑ $4x^2 - x + 3$

   Ⓒ $3x^2 + x + 6$ Ⓓ $3x^2 + 9x - 2$

4. If $9m^2 - \frac{6}{5}m + C$ is a perfect square, what is C?

   Ⓐ $\frac{36}{25}$ Ⓑ $\frac{9}{100}$ Ⓒ $\frac{1}{625}$ Ⓓ $\frac{1}{25}$

5. A banquet for a group of network executives is being catered as follows:

   > For 100 or less attending the cost is a flat $200 per person. For every person over 100 attending the cost will be reduced by one dollar a person for each person over 100.

   a) What number of executives should attend if the caterer is to maximize the amount of money they make?

   b) What is the maximum amount of money the caterer can make?

6. Consider the following inequality and equation:

   $y < x - 2$
   $y = -2x + 4$

   a) Show the solution of the system on a graph

   b) Describe the solution of the system in words

7. You bought your home for $420,000 and its value increases each year by 8%. Approximately, how many years will it take for the house to be worth $600,000?

   Ⓐ 4.6 years   Ⓑ 4.8 years

   Ⓒ 5.0 years   Ⓓ 5.2 years

8. Complete the table.

Polynomial	Factors
$x^2 - 25$	
$x^2 - 25y^2$	
$x^2y^2 - 25$	
$4x^2 - 100$	
$3x^2y^3 - 75y^3$	

---

9. Use synthetic division to divide $2x^4 - 17x^2 - 5$ by $x - 3$.

Ⓐ $Q(x) = 2x^3 + 6x^2 + x + 3$ R 4

Ⓑ $Q(x) = 2x^3 + 6x^2 + x - 3$ R 4

Ⓒ $Q(x) = 2x^3 + 3x^2 - x + 9$ R 7

Ⓓ $Q(x) = x^3 + 4x^2 - 19$ R 1

10. According to the rational root theorem, a list of all the possible rational roots of the equation $2x^3 - 5x^2 + 3x - 5 = 0$ is:

Ⓐ $\pm 1,\ \pm 2$

Ⓑ $\pm 1,\ \pm 5$

Ⓒ $\pm 1,\ \pm 5,\ \pm\frac{1}{2},\ \pm\frac{5}{2}$

Ⓓ $\pm 1,\ \pm 2,\ \pm 5,\ \pm\frac{1}{5},\ \pm\frac{2}{5},\ \pm\frac{1}{2},\ \pm\frac{5}{2}$

11. Using the Binomial Theorem, what is the expansion of $(2x - y)^5$?

Ⓐ $32x^5 - 80x^4y + 80x^3y^2 - 40x^2y^3 + 10xy^4 - y^5$

Ⓑ $x^5 + 5x^4y - 10x^3y^2 + 10x^2y^3 - 5xy^4 + y^5$

Ⓒ $2x^5 - 10x^4y + 20x^3y^2 - 20x^2y^3 + 10xy^4 - 2y^5$

Ⓓ $5x^5 - 10x^4y + 100x^3y^2 - 100x^2y^3 + 10xy^4 - 5y^5$

12. Multiply: $\dfrac{x^2 - 4x + 4}{x - 6} \times \dfrac{x^2 - 36}{x^2 - 8x + 12}$

Ⓐ $\dfrac{(x - 2)(x + 6)}{x - 6}$ Ⓑ $\dfrac{x + 2}{x - 6}$

Ⓒ $\dfrac{x - 2}{x + 6}$ Ⓓ $x - 6$

13. Simplify: $5 - \dfrac{3x + 4y}{x + 3y}$

Ⓐ $\dfrac{2x + 11y}{x + 3y}$ Ⓑ $\dfrac{33}{4}$

Ⓒ $\dfrac{9}{2}$ Ⓓ $7x + 11y$

14. A plane leaves an airport at 1pm traveling at 400 mph. One hour later, another plane leaves on the same course traveling at 440 mph. At what time will they be 50 miles apart?

Ⓐ 9:45 pm   Ⓑ 10 pm

Ⓒ 10:45 pm   Ⓓ 11 pm

15. Make up a word problem that the following equation could represent:

$$x(7x + 3) = 91$$

16. Solve by completing the square.

a) $x^2 + x = 6$

b) $4x^2 - 4x = 3$

c) $3x^2 = 7x - 4$

17. A farmer is going to plant a small orchard, and is gathering information about the amount of fruit she can expect to harvest each year once the trees mature. She is advised that, if she plants up to 60 trees of a particular type on her plot of land, the average harvest from each tree will be about 120 kg. For each additional tree planted the expected yield will go down by an average of 2 kg per tree, as a result of overcrowding. Naturally she wants to plan for the maximum yield of fruit. How many trees should she plant?

18.
$$x + 2y - 2z = -2$$
$$x \quad\ + z = 3$$
$$x - 2y - 2z = 2$$

What is the augmented matrix for the system of equations?

Ⓐ $\begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 1 \end{bmatrix}$

Ⓑ $\begin{bmatrix} 1 & 0 & 0 & -2 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \end{bmatrix}$

Ⓒ $\begin{bmatrix} 1 & 2 & -2 & -2 \\ 1 & 0 & 1 & 3 \\ 1 & -2 & -2 & 2 \end{bmatrix}$

Ⓓ $\begin{bmatrix} 1 & 2 & -2 & -2 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 1 \end{bmatrix}$

19. Y is equal to the sum of three quantities, one of which is a constant, one of which varies as x, and one of which varies inversely as x. Given Y is 17 when $x = 1$, Y is 14 when $x = 2$, and Y is 13 when $x = 3$. What is the relation between x and Y?

20. Solve the following system of equations for y:

$$3x + 2y - 4z = 11$$
$$2x - y + 3z = 0$$
$$x + 3y - 5z = 8$$

Ⓐ $-\frac{1}{2}$ Ⓑ $-1\frac{1}{2}$ Ⓒ $1\frac{1}{2}$ Ⓓ $\frac{1}{2}$

21. Addams High School started a recycling program to raise money and reduce waste. During the previous year, students sent 35,000 pounds of trash to the landfill. Officials project that the school will reduce waste by 20% each year.

a) Complete the table and create a graph that shows the projected waste reduction over the next 5 years. Label and mark your axes.

Year	Waste (lbs)
0	35000
1	
2	
3	
4	
5	
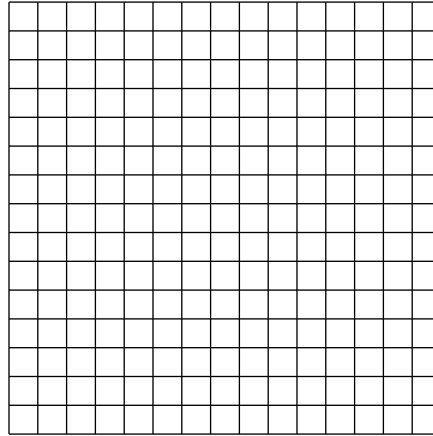
b) Write an equation that shows waste (W) as a function of time in years (t).

c) Addams' expects the waste reduction will level off at 7,000 pounds. How many years does Addams High School expect this to take?

22. Rebecca was called to the whiteboard to solve the equation $x = \sqrt{25 - 3x^2}$. Her work is shown below.

1) $x = \sqrt{25 - 3x^2}$

2) $x^2 = 25 - 3x^2$

3) $4x^2 = 25$

4) $x^2 = \frac{25}{4}$

5) $x = \pm\frac{5}{4}$

Is Rebecca's solution correct? Explain where she made her mistakes, if any, and find the correct solution.

23. Find the sum, accurate to 2 decimal places, of the nine terms of the geometric series having $t_1 = 15$ and $r = 1.2$.

Ⓐ 247.49   Ⓑ 311.98

Ⓒ 389.38   Ⓓ 562.58

24. Put the following in the form $a(x - h)^2 + k$.

a) $y = 2x^2 - 24x + 69$

b) $y = -x^2 + 6x - 8$

c) $y = 3x^2 - 3x + \frac{23}{4}$

25. If $(-3, 5)$ is a solution to the system

$$px + qy = -5$$
$$px - qy = -25$$

then the values of p and q are:

Ⓐ 5 and 2   Ⓑ −5 and 2

Ⓒ −2 and −5   Ⓓ 4 and $-\frac{1}{5}$

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Algebra

| Num	Scoring	Standard	Answer
1	C	A.APR.01	$6a^2b - 13ab^2 - 5$
2	C	A.APR.01	$5k^2 - 4nk$
3	C	A.APR.01	$3x^2 + x + 6$
4	D	A.SSE.03B	$\frac{1}{25}$
5		A.CED.02	150; $22,500
6		A.REI.12	[graph]; [answers vary]
7	A	A.CED.01	4.6 years
8		A.SSE.02	$(x + 5)(x - 5)$; $(x + 5y)(x - 5y)$; $(xy + 5)(xy - 5)$; $4(x + 5)(x - 5)$; $3y^3(x + 5)(x - 5)$
9	A	A.APR.02	$Q(x) = 2x^3 + 6x^2 + x + 3$ R 4
10	C	A.APR.03	$\pm 1,\ \pm 5,\ \pm\frac{1}{2},\ \pm\frac{5}{2}$
11	A	A.APR.05	$32x^5 - 80x^4y + 80x^3y^2 - 40x^2y^3 + 10xy^4 - y^5$
12	A	A.APR.07	$\dfrac{(x - 2)(x + 6)}{x - 6}$
13	A	A.APR.07	$\dfrac{2x + 11y}{x + 3y}$
14	A	A.CED.01	9:45 pm
15		A.CED.01	[answers vary]
16		A.REI.04B	$(-3, 2)$; $(-\frac{1}{2}, \frac{3}{2})$; $(1, \frac{4}{3})$
17		A.CED.03	30
18	C	A.REI.08	$\begin{bmatrix} 1 & 2 & -2 & -2 \\ 1 & 0 & 1 & 3 \\ 1 & -2 & -2 & 2 \end{bmatrix}$
19		A.CED.02	$Y = 11 + \dfrac{6}{x}$
20	A	A.REI.06	$-\frac{1}{2}$
21		A.CED.02	28000, 22400, 17920, 14336, 11469, [graph]; $W = 35000(0.8)^t$; 8 years
22		A.REI.01	Step 5, $x = \pm\frac{5}{2}$
23	B	A.SSE.04	311.98
24		A.REI.04A	$y = 2(x - 6)^2 - 3$; $y = -(x - 3)^2 + 1$; $y = 3(x - \frac{1}{2})^2 + 5$
25	A	A.REI.06	5 and 2

1. Express the following function in function notation:

   $$\{(x, y)| \; 2(x - 3) + 3(1 - y) = 0\}$$

   A. $f(x) = \frac{2}{3}x - 1$ B. $2x - 3y - 3 = 0$

   C. $f(x) = \frac{2}{3}x$ D. $f(x) = 2x - 1$

2. The dimensions of a rectangular container are shown in the figure.

   Length = 2x + 3

   Height = x

   Width = 2x
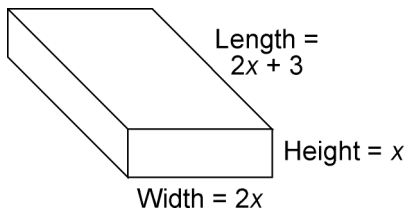
   Which of the following polynomial functions models the volume, (V), of the container in terms of x?

   A. $V(x) = 4x^3 + 3x$

   B. $V(x) = 4x^3 - 3x$

   C. $V(x) = 4x^3 + 6x^2$

   D. $V(x) = 4x^3 - 6x^2$

3. If $f(x) = 3x - 1$ and $g(x) = x^2 - 4x$, find $f(g(x))$.

   A. $3x^2 - 12x - 1$ B. $9x^2 - 18x + 5$

   C. $3x^3 - 13x^2 + 4x$ D. $\dfrac{3x - 1}{x^2 - 4x}$

4. Given the relation $\left\{(x, y): y = 3\sqrt{x^2 - 1}\right\}$:

   a) find the equations of the asymptotes in the form $y = mx + b$; and

   b) sketch the graph of the restricted relation. Plot and label a minimum of four points on the graph.

5. Which of the following graphs best illustrates the graph of $y = a(x - b)(x - c)(x - d)(x - e)$ where $a > 0$ and $b \neq c \neq d \neq e$?

   A.   B.

   C.   D.
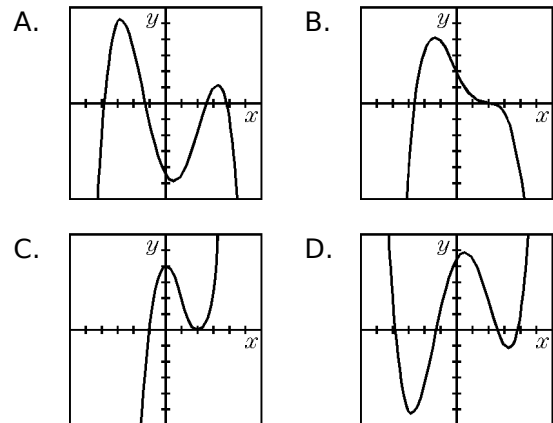
6. A scientist was carbon dating to determine how old something is. If 100 grams of a sample is remaining after 4 years and the decay formula is
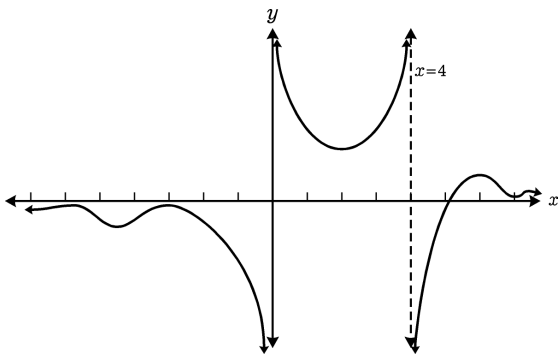
   $$R = B\left(\tfrac{1}{2}\right)^{(1/t)}$$

   where R is the amount remaining, B is the amount at the beginning and t is the time in years, how many grams was the original sample to the nearest tenth of a gram?

   A. 123.1 grams   B. 118.9 grams

   C. 111.0 grams   D. 107.2 grams

7. The graph of $h(x)$ is shown below.

a) The graph shows that $h(-4)$ is negative and $h(2)$ is positive. Could you use the Bisection Algorithm to find a zero? Why or why not?

b) The graph of the function has a zero near $x = 5$. What algorithm could you use to find this point? Explain your reasoning.

c) A minimum of $h(x)$ occurs between 0 and 4. Explain how you would use your graphing calculator to find this point.

8. A dietician graphs the effect of a nutrient on heart rate and discovers that it is $r = 2n^2$, where n is the amount of nutrient and r is the heart rate. If an enzyme is added to the nutrient, the graph changes to $r = 4n^2$. Describe how the graph of this new relationship is different from that of the original relationship.

A. The new graph is reflected about the horizontal axis (n-axis).

B. The new graph is horizontally translated to the left.

C. The new graph is vertically translated downward.

D. The new graph is narrower in its width.

9. The following are parabolic functions:

1. $f(x) = x^2 + 3$

2. $f(x) = 3x^2 - 1$

3. $f(x) = 2x^2 - 3$

4. $f(x) = x^2 + 5$

Which list places the parabolas in order from highest vertex to lowest vertex?

A. 4, 1, 2, 3   B. 2, 3, 4, 1

C. 3, 4, 1, 2   D. 4, 1, 3, 2

10. Sketch the graph of each function. Label the coordinates of all x- and y-intercepts.

a) $f(x) = \log_2 x$

b) $f(x) = -\log_2 x$

c) $f(x) = \log_2(-x)$

d) $f(x) = \log_2 |x|$

e) List all the functions from the above that have the property $f(x) = f(-x)$.

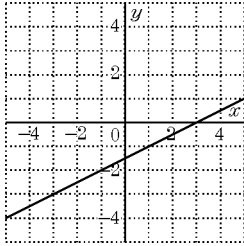11. Use the properties of logarithms to expand the expression $\log \dfrac{3x}{2y^3}$.

A. $\dfrac{\log 3x}{\log 2y^3}$

B. $\dfrac{3 \log x}{\log 2 + \log y^3}$

C. $\log 3 + \log x - \log 2 + 3 \log y$
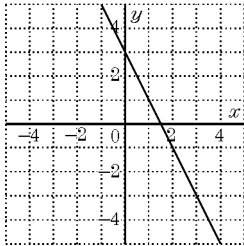
D. $\log 3 + \log x - \log 2 - 3 \log y$

12.
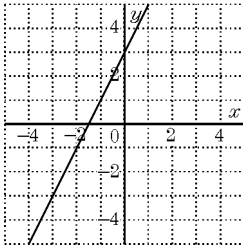
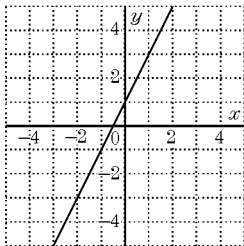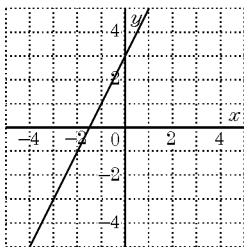The graph of $f(x) = 2x + 3$ is shown above. Which graph represents $f^{-1}(x)$?

A.

B.

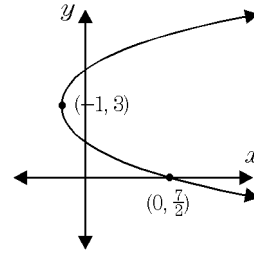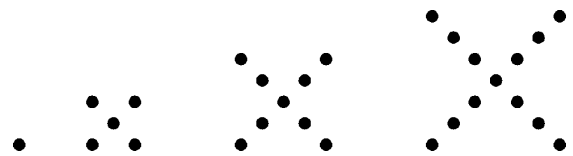

C.

D.

13. What is the equation of the inverse of the given parabola?

14. What is the recursive formula for the sequence 10, 6, 2, −2 . . . ?

A. $a_1 = 10$
$a_n = 4a_{n-1}$

B. $a_1 = 10$
$a_n = -4a_{n-1}$

C. $a_1 = 10$
$a_n = a_{n-1} + 4$

D. $a_1 = 10$
$a_n = a_{n-1} - 4$

15. Assume that the pattern of dots below continues indefinitely, with more dots being added at each step.

Ginger wants to determine the number of dots in the 20th step, but she does not want to draw all 20 steps and then count the dots.

a) Explain how Ginger could find the number of dots in step 20 without actually drawing them.

b) What would be the number of dots in the 20th step? 100th step?

16. Which investment plan is better, and by how much?

    A) $900 earning 11% simple interest for a year and a half; or

    B) $900 earning 17% interest compounded semi-annually for one year.

17. The amount of money A after t years that a principal amount P will amount to if it is invested at rate r compounded n times a year is given by the relationship

$$A(t) = P\left(1 + \frac{r}{n}\right)^{nt}$$

where r is expressed as a decimal.

To 1 decimal place, how long with it take:

a) $2500 to become $4500 if it is invested at 7% and is compounded quarterly?

b) $3600 to become $5200 if it is invested at 9% and is compounded semi-annually?

c) a sum of money to double if it is invested at 12% and compounded annually?

d) a sum of money to double if it is invested at 12% and compounded semi-annually?

18. Tamara puts some fresh cod filets that she bought on sale at the grocery store in the freezer. Which graph best describes their temperature as a function of time?

A.

B.

C.

D.
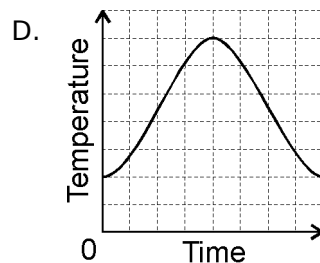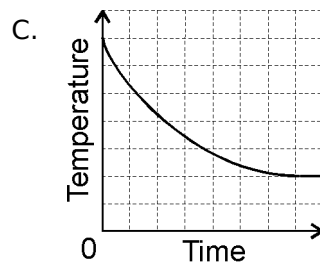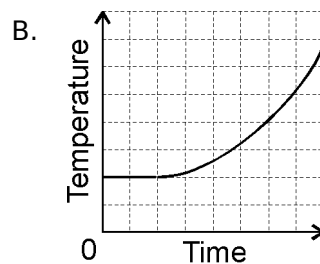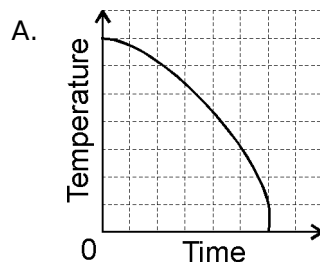
19. Make up a situation that the graph could represent.
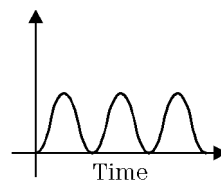
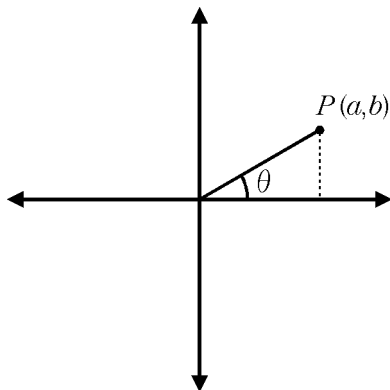20. Determine the exact value of $\cos \dfrac{11\pi}{6}$.

    A. $\dfrac{\sqrt{3}}{2}$ B. $\dfrac{1}{2}$ C. $-\dfrac{1}{2}$ D. $\dfrac{\sqrt{2}}{2}$

21.

For the given diagram, point P is 1 unit away from the origin. If $\sin^2\theta = \dfrac{1}{2}$, find the coordinates of point P.

    A. $(2\sqrt{2}, \sqrt{2})$ B. $(\dfrac{\sqrt{2}}{2}, \dfrac{\sqrt{2}}{2})$

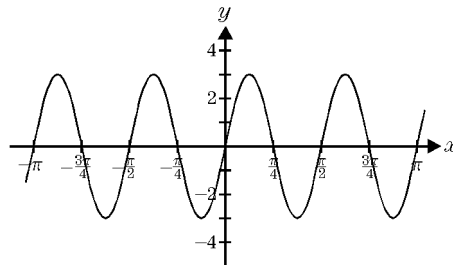   C. $(\dfrac{1}{2}, \dfrac{1}{2})$ D. $(\dfrac{\sqrt{2}}{2}, \dfrac{1}{2})$

22. To 3 decimal places find:

    a) $\sec 0.23^R$

    b) $\csc 2.34^R$

    c) $\cot(-0.82)^R$

23. If $y = f(x)$ has a period of 12, then what is the period of $y = f(x - 6)$?

    A. 2   B. 12   C. 72   D. 3

24. Given the graph for $f(x) = 3\sin 4x$, over which domain could $f^{-1}(x)$ be constructed?

    A. $\left[-\dfrac{3\pi}{8}, -\dfrac{\pi}{8}\right]$ B. $\left(0, \dfrac{\pi}{4}\right)$

    C. $\left[\dfrac{\pi}{4}, \dfrac{3\pi}{4}\right]$ D. $\left(\dfrac{3\pi}{8}, \dfrac{7\pi}{8}\right)$

25. A Ferris wheel has a radius of 30 m. Its center is 31 m above the ground. It rotates once every 40 s. Suppose you get on the bottom at $t = 0$. Write an equation that expresses your height as a function of elapsed time.
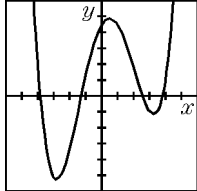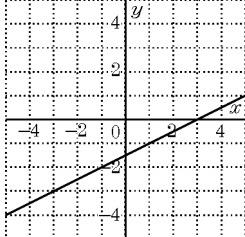
    A. $h = 31\cos 2\pi\dfrac{(t - 40)}{40} + 30$

    B. $h = 30\cos 2\pi\dfrac{(t - 20)}{40} + 1$

    C. $h = 30\cos 2\pi\dfrac{(t - 20)}{40} + 31$

    D. $h = \cos 2\pi\dfrac{(t - 20)}{40} + 30$

26. Simplify: $\dfrac{1}{1 + \sin\theta} + \dfrac{1}{1 - \sin\theta}$

    A. 0   B. $2\csc^2\theta$

    C. $2\sec^2\theta$ D. $\sin\theta\cos\theta$

Functions

Num	Scoring	Standard	Answer
1	A	F.IF.02	$f(x) = \frac{2}{3}x - 1$
2	C	F.IF.02	$V(x) = 4x^3 + 6x^2$
3	A	F.BF.01C	$3x^2 - 12x - 1$
4		F.IF.07B	$y = \pm 3x$; [graph]
5	D	F.IF.07C	
6	B	F.IF.08B	118.9 grams
7		F.BF.01A	Bisection will not reveal the zero between -4 and 2 because of the asymptote at $x = 0$. This asymptote would be approached as the zero. Bisection is best. x-values near $x = 5$ result in positive and negative y-values. Use zoom and trace to search for the minimum y-value between $x = 5$ and $x = 6$.
8	D	F.BF.03	The new graph is narrower in its width.
9	A	F.BF.03	4, 1, 2, 3
10		F.IF.07E	[graph]; [graph]; [graph]; [graph]; d
11	D	F.BF.05	$\log 3 + \log x - \log 2 - 3\log y$
12	A	F.BF.04C	
13		F.BF.04C	$y = 4(x - 3)^2 - 1$ or equivalent
14	D	F.IF.03	$a_1 = 10$ $a_n = a_{n-1} - 4$
15		F.BF.02	$4n - 3$; 77
16		F.LE.03	Plan B by $11.00
17		F.LE.04	8.5 years; 4.2 years; 6.1 years; 5.9 years

18	C	F.LE.05	
19		F.LE.05	[answers vary]
20	A	F.TF.09	$\frac{\sqrt{3}}{2}$
21	B	F.TF.08	$(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$
22		F.TF.02	1.027; 1.392; −0.933
23	B	F.TF.04	12
24	A	F.TF.06	$\left[-\frac{3\pi}{8}, -\frac{\pi}{8} \right]$
25	C	F.TF.05	$h = 30\cos 2\pi\frac{(t-20)}{40} + 31$
26	C	F.TF.08	$2\sec^2\theta$

1. Which of the following figures shows the construction of an angle bisector?

    Ⓐ

    Ⓑ

    Ⓒ

    Ⓓ
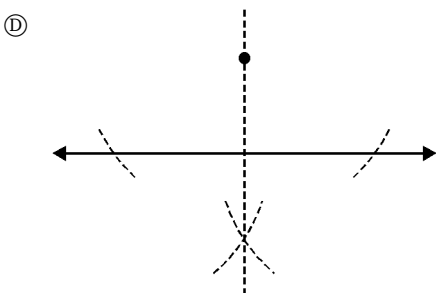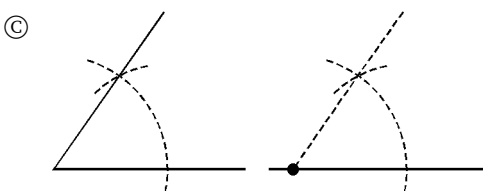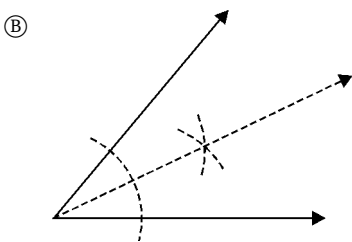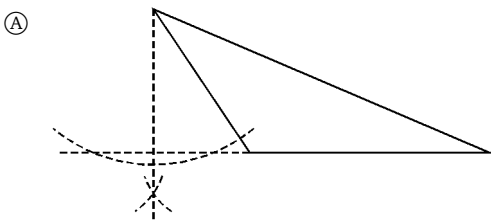
2. Given $A(-2, 4)$, $B(6, 2)$, $C(8, 6)$ and $D(0, 8)$.

    a) Find the midpoints of quadrilateral $ABCD$. Call them E, F, G, and H respectively.

    b) Find the lengths of $\overline{EF}$ and $\overline{GH}$.

    c) Find the lengths of $\overline{FG}$ and $\overline{EH}$.

    d) What kind of quadrilateral is $EFGH$?

3. Which of these symbols have point symmetry?

    I.

    II.

    III.

    IV.

    Ⓐ I only   Ⓑ IV only
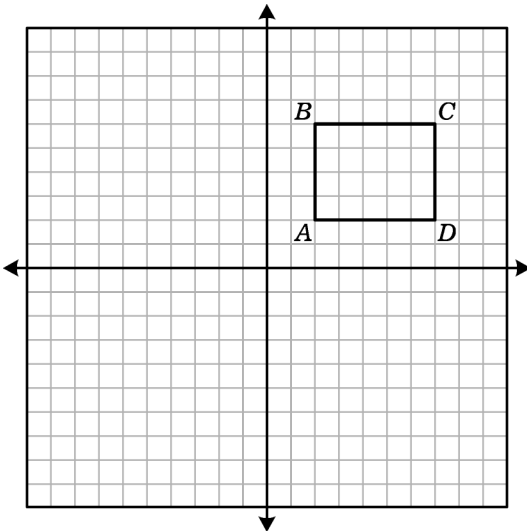
    Ⓒ I and II only   Ⓓ all except II

4. Given the points $C(0, 0)$, $A(0, 8)$ and $T(6, 0)$:

    a) Graph $\triangle CAT$.
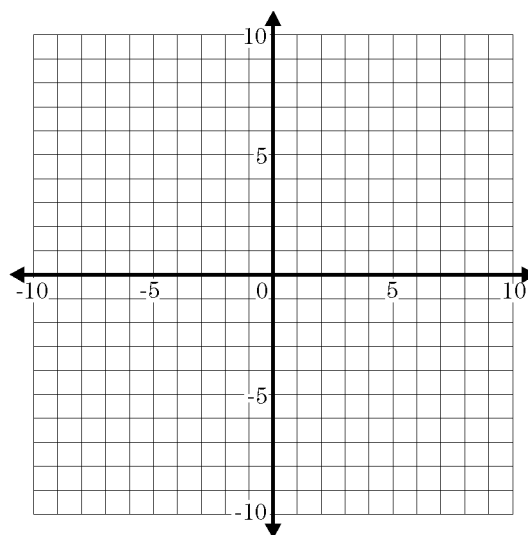
    b) Rotate $\triangle CAT$ 90° counterclockwise about the origin. Graph the new triangle on the coordinate system above. Label the new vertices.

    c) Find the area of the new triangle. How do the two areas compare?

5.

Using the coordinate plane, which of the following statements would result in figure *ABCD* being in Quadrant IV?

    I.   Figure *ABCD* is reflected across the *x*-axis.

    II. Figure *ABCD* is reflected across the *y*-axis.

    III. Figure *ABCD* is translated 4 units to the left and 2 units down.

    IV. Figure *ABCD* is rotated 90° about point *B*.

Ⓐ I only   Ⓑ II only

Ⓒ III only   Ⓓ IV only

6.   Given the diagram as marked △*ABC* is scalene and $\overline{CD}$ is an angle bisector. To prove that $\overline{CD}$ cannot be perpendicular to $\overline{AB}$ the steps are given but not necessarily in the correct order, and one step is missing. Find the missing step.

    I.   Therefore $m\angle A = m\angle B$ and △*ABC* is isosceles.

    II. △*CDA* ≅ △*CDB* by ASA.

    III. $CD = CD$.

    IV. Therefore assumption is false and *CD* is not perpendicular to *AB*.

    V. $m\angle ACD = m\angle BCD$
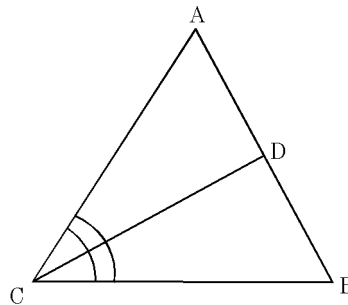
Ⓐ Assume $m\angle CDA = m\angle CDB = 90$.

Ⓑ $m\angle A = m\angle B$.

Ⓒ Assume $CA = CB$.

Ⓓ There is no missing step.

7.
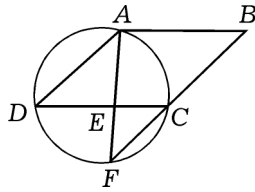
Given: *ABCD* is a parallelogram

Prove: *AF = AB*

statement	reason
1. _____	Given
2. *m∠B = m∠ADC*	_____
3. *m∠AFC = m∠ADC*	_____
4. _____	both = *m∠ADC*
5. _____	_____

---

8.   Given: $\overline{AC}$ and $\overline{BD}$ bisect each other

Prove: $\overline{AD} \parallel \overline{BC}$

Which of the following statements is *not* needed, if the proof makes use of the other three?
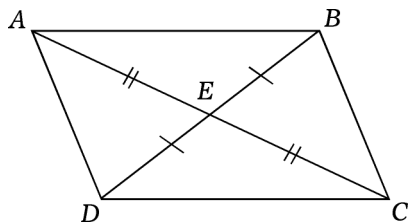
Ⓐ $\triangle AED \cong \triangle CED$

Ⓑ   *AB = DC*

Ⓒ   *m∠AEB = m∠DEC*

Ⓓ   *AE = EC* and *DE = EB*

9.   In the figure, $\overline{NQ}$ is parallel to $\overline{OP}$ and *NQ* = 4, *OP* = 6, and *MQ* = 8. If *NO* = 2, how long is $\overline{QP}$?

Ⓐ   2   Ⓑ   4

Ⓒ   6   Ⓓ   10
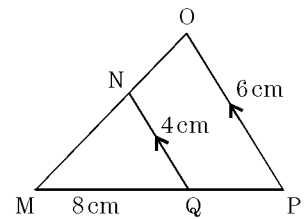
10.   In $\triangle ABC$, *AC* = 10, *BC* = 8, *m∠B* = 90° and *m∠BDA* = 90°. How long is $\overline{CD}$?

Ⓐ   3.6   Ⓑ   4

Ⓒ   5   Ⓓ   6.4
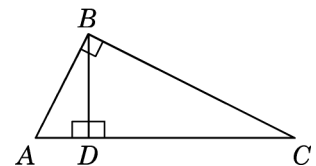
11. A partial map San Francisco's North Beach neighborhood is shown below. The distance between streets is 440 yds and between roads is 580 yds. The measure of $\angle ZDC$, where Stockton Street and Columbus Avenue intersect, is 62°. The length of $\overline{ZE}$, the distance on Mason Street between Green Road and Columbus Avenue, is 235 yds.

a) What is the measure of $\angle FYX$, the intersection of Leavenworth Street and Columbus Avenue?

b) Name two triangles that are similar to $\triangle XAY$.

c) What is the length of $\overline{XB}$, the distance on Beach Road between between Columbus Avenue and Mason Street? Round to the nearest integer and show all your work.

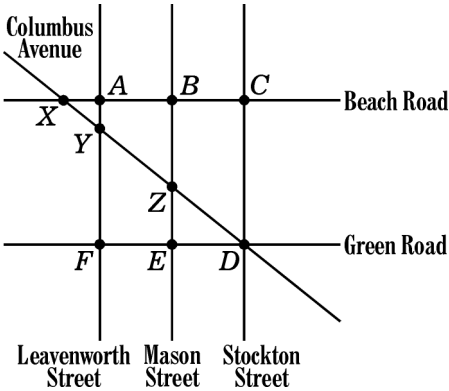12. The angle θ is in the first quadrant and $\sin\theta = \frac{2}{\sqrt{13}}$.

Determine possible coordinates for point P on the terminal arm of θ.

Ⓐ $(\sqrt{13}, 2)$ Ⓑ $(2, 3)$

Ⓒ $(3, 2)$ Ⓓ $(3, \sqrt{13})$

13. You are trying to buy a neutral present for your neighbor's birthday so you decide on a box of candy. The box is in the shape of a pentagonal prism. What is the volume of the box?
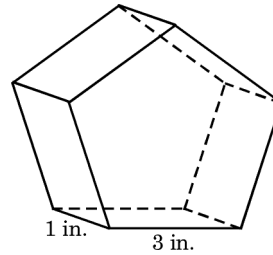
Ⓐ 18 in³   Ⓑ 309 in³

Ⓒ 30.9 in³   Ⓓ 15.45 in³

14. To the nearest tenth of a square centimeter, what is the area of the triangle shown?

Ⓐ 107.9

Ⓑ 135.9

Ⓒ 156.5

Ⓓ 196.9
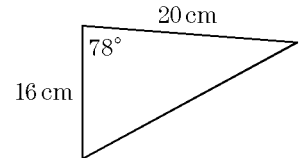
15. Two ships leave point A at 10:30 am. One travels in a direction of 049° (N 49° E) at 12 miles per hour and the other travels in a direction of 135° (S 45° E) at 14 miles per hour. How far apart, to the nearest mile, will they be at noon?

Ⓐ 27   Ⓑ 26   Ⓒ 25   Ⓓ 28

16. The circle shown has an equation in the form of $(x - h)^2 + (y - k)^2 = 4$
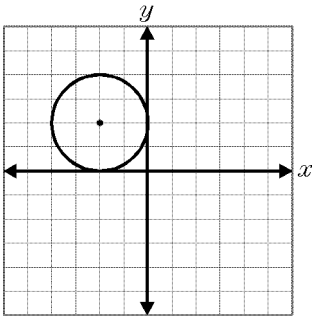
If the values of h and k were changed to opposite signs, which of the following is the graph of the new circle?
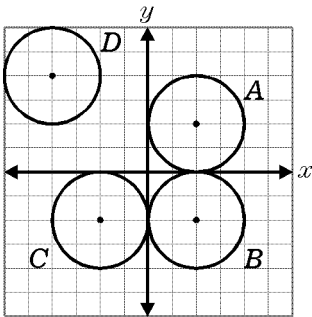
Ⓐ *A*   Ⓑ *B*   Ⓒ *C*   Ⓓ *D*

17. In the circle shown, quadrilateral *ABCD* is inscribed in the circle. $\overline{FE}$ is a tangent and $\overline{BD}$ is a diagonal. If $m\angle A = 2x - 15$, $m\angle C = 3x - 25$, $m\angle BDC = 30$, and $m\angle ADF = 70$, what is $m\angle ABD$?

Ⓐ 70°   Ⓑ 60°

Ⓒ 45°   Ⓓ 50°
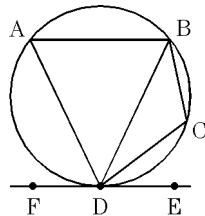
18. In the diagram, the inscribed angle $\angle ABC$ has a measure of $50°$, $\overline{AB} \cong \overline{BC}$, and the radius of the circle shown is 10 units. What is the length of $\overset{\frown}{AB}$?

Ⓐ $\frac{35\pi}{16}$ Ⓑ $\frac{42\pi}{5}$

Ⓒ $\frac{65\pi}{6}$ Ⓓ $\frac{65\pi}{9}$
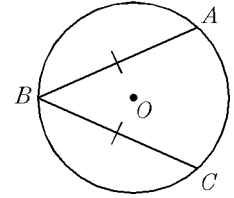
19. In the circle below, the center is O, the radius is 15 cm, and chord $XY = 18$ cm
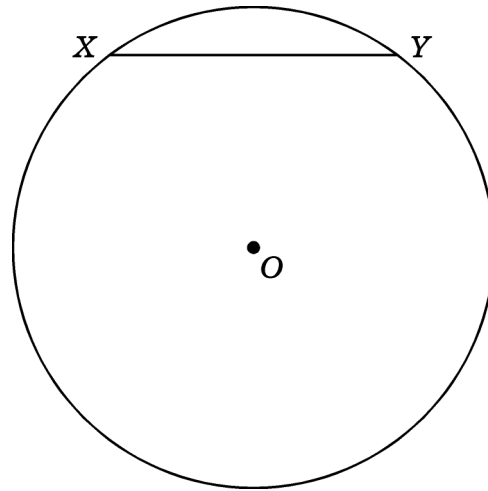
a) Construct $\overline{OP}$ perpendicular to $\overline{XY}$, where P is a point on $\overline{XY}$.

b) What is the length of $\overline{OP}$?

c) Find $m\angle XYO$ to the nearest hundredth degree.

20. A florist is creating centerpieces for an awards dinner. As a base for each centerpiece, the florist uses a sphere of floral foam that has an 8 inch diameter. A horizontal slice is removed from the bottom of the sphere so that the centerpiece lies flat.
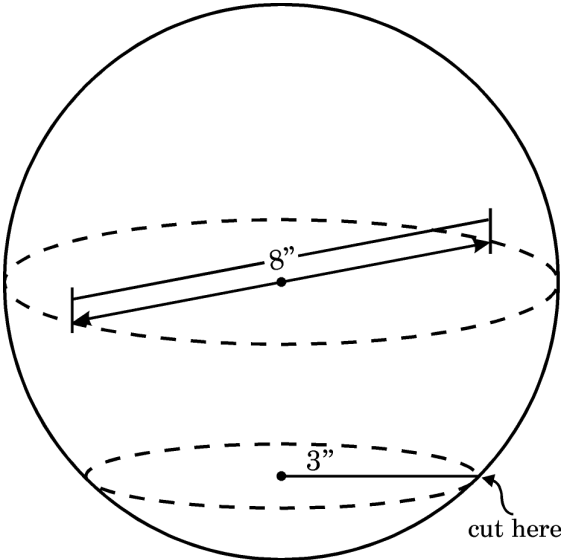
The radius of the flat surface of the slice is 3 inches. What is the approximate height of the floral foam?

Ⓐ 8 in   Ⓑ 7.5 in   Ⓒ 6.5 in   Ⓓ 5 in

21. The figure shows a sphere with radius r fitting exactly inside of a right cylinder. The height of the cylinder is $2r$.
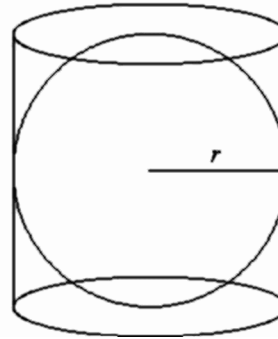
Could a plane, if it intersects the sphere and the cylinder, form two concentric circles?

Ⓐ No, any intersection would result in a point and a circle, or just one circle.

Ⓑ No, any intersection would result in a circle and an oval.

Ⓒ Yes, if the plane is parallel to the top and bottom of the cylinder and does not go through the middle.

Ⓓ Yes, if the plane intersects the top and bottom of the cylinder and is not tangent to the side.

22. Write the equation of the parabola that opens down, has a vertex $V(-2, 51)$, and is congruent to $y = -4x^2$. Answer in the form $y = a(x - h)^2 + k$.

Ⓐ $y = 4(x - 2)^2 - 51$

Ⓑ $y = -4(x - 2)^2 - 51$

Ⓒ $y = 4(x + 2)^2 + 51$

Ⓓ $y = -4(x + 2)^2 + 51$

23. What is the equation of the given hyperbola?

Ⓐ $9x^2 + 4y^2 = 36$

Ⓑ $9x^2 - 4y^2 = -36$

Ⓒ $9x^2 - 4y^2 = 36$

Ⓓ $4x^2 - 9y^2 = 36$
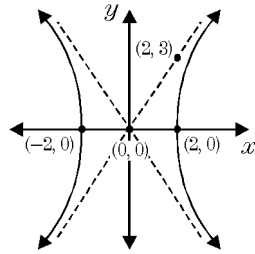
24. Vinh is thinking of buying a block of land to build a house. The land is less expensive because it is an unusual shape. It is a right-angled triangle with sides of length 30 m, 40 m, and 50 m. Vinh wants the floor plan of the house to be a rectangle with two sides along the two shorter sides of the block and one corner on the hypotenuse. What are the dimensions of the largest house that could be built on the land?

40 m
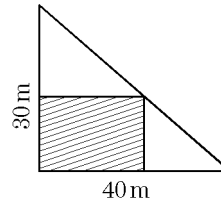
25. Given: $\overline{AC}$ is the median to $\overline{BE}$,
$\overline{EC}$ is the median to $\overline{AD}$.
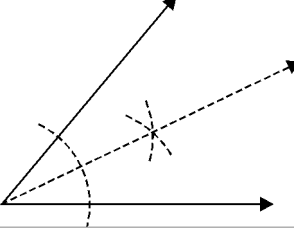
Prove: $\overline{AB} \parallel \overline{ED}$
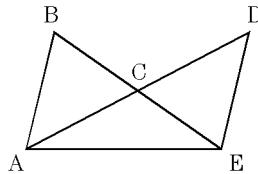
Statements	Reasons

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Geometry

Num	Scoring	Standard	Answer
1	B	G.CO.12	
2		G.GPE.04	$E(2,3)$, $F(7,4)$, $G(4,7)$, $H(-1,6)$; $\sqrt{26}$, $\sqrt{26}$; $3\sqrt{2}$, $3\sqrt{2}$; parallelogram
3	D	G.CO.04	all except II
4		G.CO.05	[graph]; $(0,0)$, $(-8,0)$, $(0,6)$; 24 square units, area is the same.
5	A	G.CO.05	I only
6	A	G.CO.10	Assume $m\angle CDA = m\angle CDB = 90$.
7		G.C.01	[proof]
8	B	G.CO.11	$AB = DC$
9	B	G.SRT.05	4
10	D	G.SRT.08	6.4
11		G.SRT.05	118°; $\triangle XBZ$, $\triangle XCD$, $\triangle DEZ$, $\triangle DFY$; 646 yds
12	C	G.SRT.08	$(3,2)$
13	D	G.SRT.08	$15.45\,\text{in}^3$
14	C	G.SRT.09	156.5
15	A	G.SRT.11	27
16	B	G.GPE.01	B
17	A	G.C.03	70°
18	D	G.C.05	$\frac{65\pi}{9}$
19		G.C.02	[task]; 12; 53.13°
20	C	G.GMD.03	6.5 in
21	C	G.GMD.04	Yes, if the plane is parallel to the top and bottom of the cylinder and does not go through the middle.
22	D	G.GPE.02	$y = -4(x+2)^2 + 51$
23	C	G.GPE.03	$9x^2 - 4y^2 = 36$
24		G.MG.03	20 m by 15 m
25		G.CO.10	[proof]

1.

Stopping Distance (in feet)
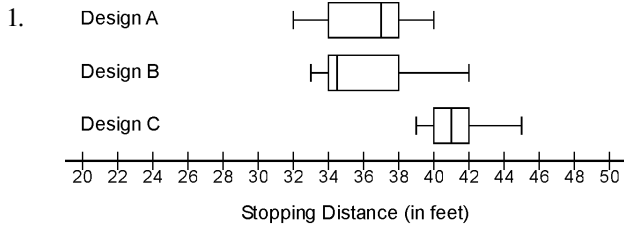
The distance required to stop an Ice Road Trucker and his big rig on a sheet of ice was measured to compare the stopping ability of 3 different tread designs. The results are in the figure below. Which tread design should be chosen if you owned the trucking company?

A. tread design A

B. tread design B

C. tread design C

D. tread design B or C

2. The following table shows a student's test scores for 5 subjects, the mean score for that test, and the standard deviation for that test.

Subject	Test Score	Mean Score	Standard Deviation
Math	84	80	10
Chemistry	82	80	6
Physics	85	83	8
Biology	78	75	4
History	90	81	13

In which course is the student's relative standing the highest?

A. Math

B. Chemistry

C. Biology

D. History

3. In Australia, a study of farms with 30 or fewer sheep produced the following data.

Number of Sheep per Farm (x_i)	Number of Farms (f_i)
15	6
20	3
22	5
25	4
30	2

a) What is the mean for the number of sheep per farm?

b) Find the standard deviation to the nearest tenth.

c) What is the total number of farms that lie within one standard deviation of the mean?

4. The weights of a bags of pretzels are distributed normally with a mean of 385 grams and a variance of 361. What percent of pretzel bags will likely weigh less than 423 grams?

A. 65.54   B. 97.72   C. 17.11   D. 47.72

5. The correlation between anxiety and performance on complex tasks is −0.73. Which of the following may be concluded?

A. As anxiety increases, performance on complex tasks improves.

B. As performance on complex tasks improves, anxiety tends to decrease.

C. As anxiety decreases, so does performance.

D. High performance is because of low anxiety.

6. A teacher wants to know if the number of absences a student has affects the test score. In the data, the independent variable is Number of Absences.

Use your calculator to determine the equation of the linear regression line for the data.

Number of Absences	Test Score
7	55
8	68
9	70
12	78
14	84

A. $y = 3.56x + 35.41$ B. $y = 2.78x + 79.06$

C. $y = 0.25x - 7.75$ D. $y = 8.34x + 80.17$

7. The chart below shows the number of people who viewed a particular YouTube video during the first few days after its posting. Use an equation that best models this data to predict the day when the video will be viewed by 12,000 people.

Day	Viewings
1	54
2	260
3	560
4	850
5	1250
6	1500

A. day 40   B. day 42

C. day 44   D. day 46

8. The Gross National Income (GNI) in billions of dollars of a small European country between 1997 and 2008 is shown in the table below.

Year	1997	1998	1999	2000	2001	2002
GNI	9.01	9.54	9.94	10.22	10.66	11.34
Year	2003	2004	2005	2006	2007	2008
GNI	12.84	14.14	15.90	18.13	20.55	21.16

a) Find the exponential function that best fits the data. Code the years so that 1997 = 0, 1998 = 1, etc.

b) What do the coefficients represent in the function you created in the previous part?

c) Does the function reasonably describe the GNI growth for this country?

d) Use the best fit function to estimate what this country's GNI will be in 2020. What does this estimate presume about the country?

9. The student council at a local high school is collecting data to determine the top ten favorite songs of the students in the school. Which of the following methods represents stratified sampling?

A. interview every second student who arrives at school Monday morning

B. randomly interview 10% of students from each grade

C. survey all the students in grade 9

D. interview students who download music on the web.

10. To collect data about the kinds of pets people own, Rebecca interviews everyone who brings their pet to a local Animal Hospital. What type of sample does this represent?

A. a random sample

B. a stratified sample

C. a self-selective sample

D. a convenience sample

11. Which of the following are advantages of using a cluster sample?

    I.   It enables the person doing the study to get more detailed information about a particular subject.

    II. A numbered list may already exist.

    III. It can simplify fieldwork.

    IV. It is convenient.

    V. Ease of selecting the sample.

A. I only

B. II only

C. I, III and IV only

D. I, III, IV and V only

12. To determine the preferred van driven by families with children, a car company located in Oshawa surveyed 10% of the families living there.

a) What type of sampling method was used?

b) What were the advantages of this method?

c) What were the disadvantages of this method?

d) Suggest an improvement that could be made to collect the data.

13. For extra credit in his Statistics class, Josh needs to collect data and analyze it. He asks a random sampling of classmates in his 3rd and 4th periods how many consecutive jumps they can make while jump-roping. The data is in the table below.

3rd Period	4th Period
36	54
23	67
15	54
72	36
14	19
10	67
42	99
54	31
43	56
20	70
19	13
59	44
95	59
65	22
73	40
	59
	11

What is the mean and standard deviation for each period? Round to two decimal places.

A. 3rd Period: mean = 45.00, σ= 23.54. 4th Period: mean = 49.38, σ= 24.67.

B. 3rd Period: mean = 38.93, σ= 21.19. 4th Period: mean = 43.89, σ= 26.51.

C. 3rd Period: mean = 41.98, σ= 24.37. 4th Period: mean = 42.76, σ= 23.84.

D. 3rd Period: mean = 42.67, σ= 26.15. 4th Period: mean = 47.12, σ= 23.45.

14. Miriam has seven toy animals in a box. She pulls out a toy, records the animal, and returns it to the box. She repeats this process 40 times. Her results are shown in the table below.

Animal	Panda	Giraffe	Lion	Elephant
Frequency	12	6	5	17

Based on these results, how many of each animal are in the box? Explain your reasoning.

15.
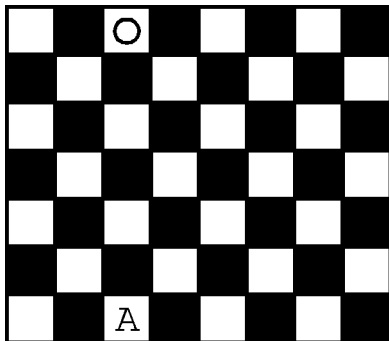
The disk on the board at 'o' is permitted to move diagonally forward on the white squares. How many paths are there for the disk to reach the square labeled 'A'?

A. 7   B. 12   C. 19   D. 25

16. A spinner is divided into twelve lettered sections, as shown. (Assume the arrow never lands on a dividing line.)

With just one spin, what is the probability of landing on a vowel or an unshaded region?

A. $\frac{1}{3}$ B. $\frac{1}{2}$

C. $\frac{5}{8}$ D. $\frac{3}{4}$
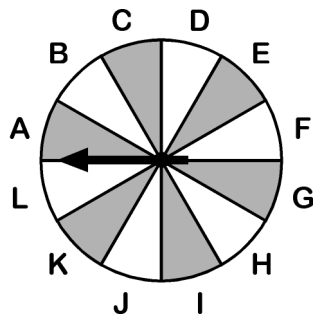
17. For two people, actuarial tables say the probability that person A will die before age 86 is 0.7, and that the probability that person B will die before age 86 is 0.6. What is the probability that at least one of A and B dies before the age of 86?

A. 0.88   B. 0.60   C. 0.92   D. 0.84

18. Two packets each contain 8 seeds. Of the seeds from the first package, three will produce red flowers and five will produce white flowers. Of the seeds from the second package, four will produce red flowers and four will produce white flowers. A seed is chosen that produces a red flower. What is the probability of the seed coming from the first package? (The probability of choosing each packet is $\frac{1}{2}$.)

A. $\frac{7}{16}$ B. $\frac{3}{16}$ C. $\frac{3}{7}$ D. $\frac{5}{9}$

19. A test for a certain disease is found to be 95% accurate when testing people who have the disease. However, the same test gives a false-positive result for 3% of the healthy patients tested. For a certain segment of the population the incidence of the disease is 8%. If a person tests negative for the disease, find the probability that the person actually has the disease.

A. 0.004   B. 0.266   C. 0.734   D. 0.996

20. Mr. Garcia put 4 half-dollars, 5 quarters and 3 dimes on the shelf. If two coins are taken at random, what is the probability of selecting a half-dollar and then a dime? (Answers are approximate.)

A. 0.09   B. 0.15   C. 0.33   D. 0.67

21. Two cards are drawn at random from a standard deck of cards without replacement.

   a) How many ways can 2 cards be drawn?

   b) What is the probability of selecting 2 aces?

   c) What is the probability of selecting 2 red cards?

22. A box contains 6 red, 2 white, and 4 blue marbles. You will draw one marble, then put it back in the box. Then you will draw a second marble.

   a) What is the probability that you will draw a red marble and then a white marble?

   b) This time you will *not* replace the marble drawn first. What is the probability that you will draw a blue marble and then another blue marble?

23. Based on past experience, a building contractor sets the probability of winning a contract at 0.30. The contract is worth $25,000 and the cost to prepare the contract proposal is $2400. What is the expected value of the contract proposal?

   A. $5100   B. $-$22600

   C. $22600   D. $-$5100

24. You have 8 white balls and 8 black balls and two empty boxes. How should the balls be arranged in the two boxes in order to maximize the probability of drawing a white ball and what is this probability?

25. There are 208 students enrolled in the local high school. The foreign language department offers French, German, and Spanish.

   - 4 students take all three languages.
   - 48 students study French.
   - There are twice as many students who study both French and Spanish (but not German) as who study both French and German (but not Spanish), and 4 times as many as who study all 3.
   - 124 students study Spanish.
   - 27 students do not study any foreign language.
   - The group of students who study both French and Spanish (but not German) is exactly the same size as the group made up of students who study both German and Spanish.

   What is the probability that a student studies German or French but not Spanish?

   A. $\frac{57}{208}$ B. $\frac{3}{52}$ C. $\frac{1}{26}$ D. $\frac{1}{13}$

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Statistics and Probability

Num	Scoring	Standard	Answer
1	A	S.ID.02	tread design A
2	C	S.ID.04	Biology
3		S.ID.04	21; 4.7; 12
4	B	S.ID.04	97.72
5	B	S.ID.08	As performance on complex tasks improves, anxiety tends to decrease.
6	A	S.ID.06A	$y = 3.56x + 35.41$
7	B	S.ID.06A	day 42
8		S.ID.06A	$f(x) = 8.1316(1.0899)^x$; 8.1316 = GNI in 1997, 1.0899 = rate of increase of the GNI; Answers vary; 58.89 billion, presume the GNI increases along the same pattern
9	B	S.IC.03	randomly interview 10% of students from each grade
10	D	S.IC.03	a convenience sample
11	D	S.IC.03	I, III, IV and V only
12		S.IC.03	Cluster sampling. It was a quick and easy way to collect information. It chose families in one city only and these could be employees of the car company. Interview about 5% of families with children of other cities in each province.
13	D	S.IC.05	3rd Period: mean = 42.67, σ = 26.15. 4th Period: mean = 47.12, σ = 23.45.
14		S.IC.04	2 Pandas, 1 Giraffe, 1 Lion, 3 Elephants
15	D	S.CP.09	25
16	D	S.CP.07	$\frac{3}{4}$
17	A	S.CP.07	0.88
18	C	S.CP.08	$\frac{3}{7}$
19	A	S.CP.08	0.004
20	A	S.CP.09	0.09
21		S.CP.09	1,326; $\frac{6}{1,326}$; $\frac{325}{1,326}$
22		S.MD.03	$\frac{1}{12}$; $\frac{1}{12}$
23	A	S.MD.04	$5100
24		S.MD.05B	7 white and 8 black in one box and the last white in the other box, $\frac{11}{15}$
25	A	S.MD.03	$\frac{57}{208}$