1. A farmer has 10 acres to plant in wheat and rye. He has to plant at least 7 acres. However, he has only $1200 to spend and each acre of wheat costs $200 to plant and each acre of rye costs $100 to plant. Moreover, the farmer has to get the planting done in 12 hours and it takes an hour to plant an acre of wheat and 2 hours to plant an acre of rye. If the profit is $500 per acre of wheat and $300 per acre of rye how many acres of each should be planted to maximize profits?

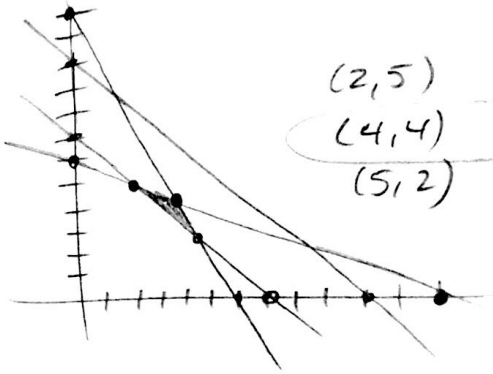
$x+y \le 10$ (0,10) (10,0)

$x+y \ge 7$ (0,7) (7,0)

$200x+100y \le 1200$

$x+2y \le 12$ (0,6) (12,0) (0,6) (6,0)

$P = 500x + 300y$ (max!)



	500x + 300y
(2,5)	2500
(4,4)	3200
(5,2)	3100

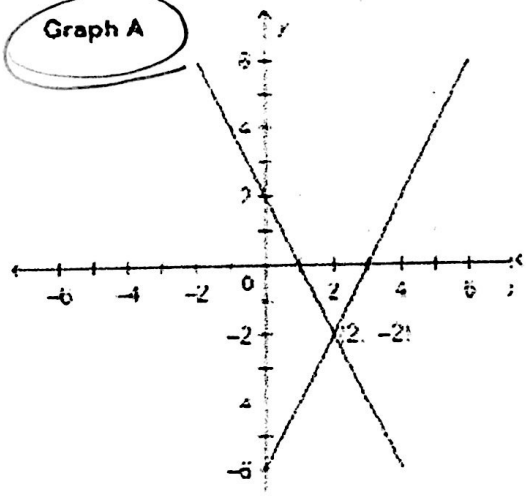
4 acres of each for a profit of $3200

2. Which graph represents the solution of the linear system:

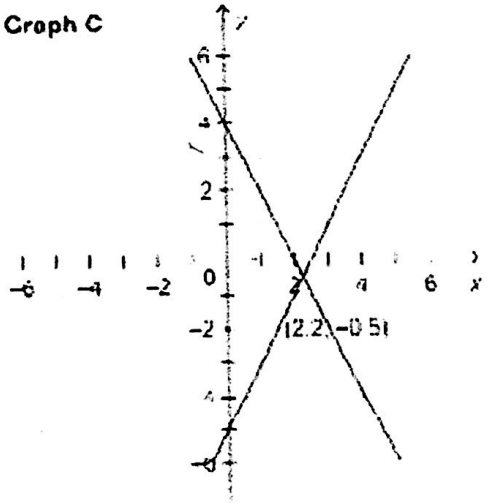
$y = -2x + 2$

$y + 6 = 2x$ $y = 2x - 6$

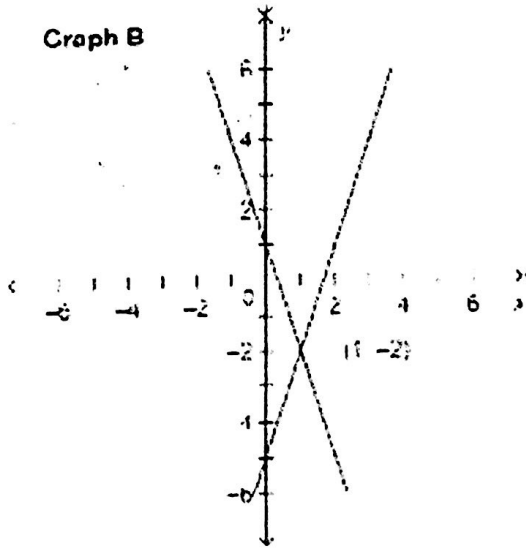
Graph A



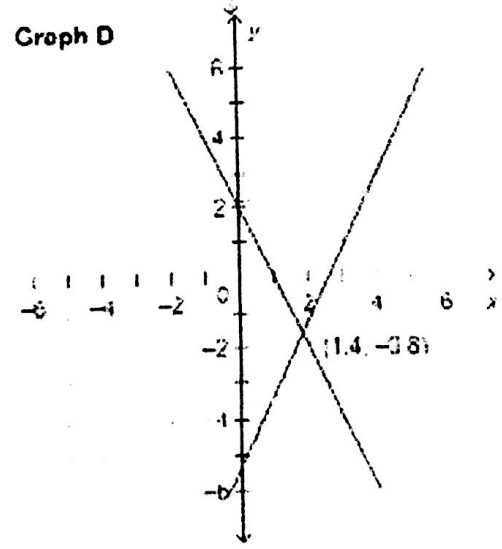
Graph C



Graph B



Graph D



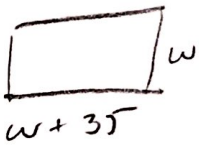
Create a linear system to model this situation: $j = 5 + 2a$
In a board game, Judy scored 5 points more than twice the number of points Ann scored. $j + a = 65$
There was a total of 65 points scored.

a. $j = 5 + 2a$, $j + a = 65$
b. $j - 5 = 2a$, $j + 2a = 65$
c. $j + 5 = 2a$, $j + a = 65$
d. $a = 5 + 2j$, $j + a = 65$

Create a linear system to model this situation:
A woman is 3 times as old as her son. In thirteen years, she will be 2 times as old as her son will be.

a. $w = s + 3$, $w + 13 = 2s$ $\quad w = 35$
b. $w = 3s$, $w + 13 = 2(s + 13)$
c. $w = 3s$, $w = 2s$ $\quad w + 13 = 2(s + 13)$
d. $w = 3s$, $s + 13 = 2(w + 13)$

Create a linear system to model this situation: $l = w + 35$
A rectangular field is 35 m longer than it is wide. The length of the fence around the perimeter of the field is 278 m. $P = 2l + 2w = 278$



a. $l + 35 = w$, $2l + 2w = 278$
b. $l = w + 35$, $2l + 2w = 278$
c. $l = w + 35$, $l + w = 278$
d. $l = w + 35$, $lw = 278$

4. Determine the seating capacity of an auditorium with 36 rows of seats, if there are 15 seats in the first row, 18 seats in the second row, 21 seats in the third row, and so on. $a_1 = 15$, $d = 3$

$S_{36} = \frac{36(15 + 120)}{2} = 2430$ seats

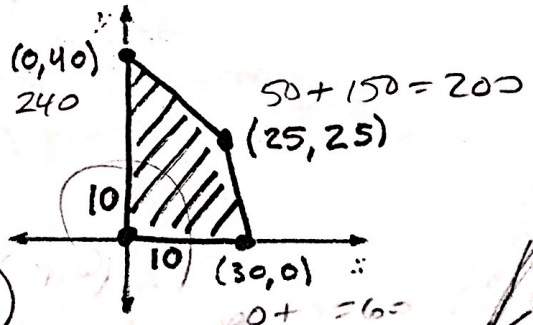
$a_{36} = 15 + 3(35) = 120$

5. Find the 41st term in the sequence whose general term is $t_n = -3 + 4(n - 1)$.

a) 40 b) 157 c) 198 d) 221

$t_{41} = -3 + 4(40) = 157$

Given the feasible region shown, what is the maximum value of the objective function $C = 2x + 6y$?



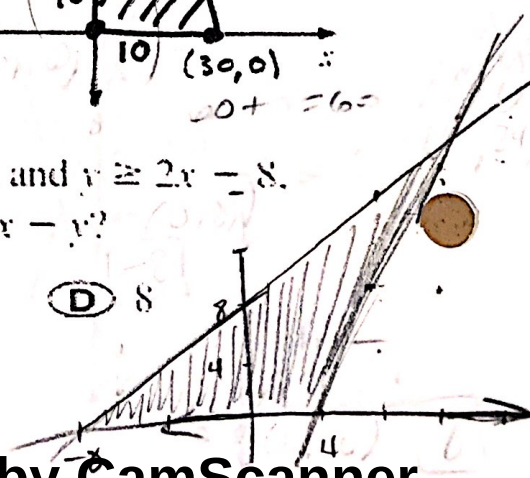
(A) 0 (B) 60 (C) 200
(D) 276 (E) 326

240

Given the constraints $y \geq 0$, $y \leq x + 8$, and $y \geq 2x - 8$, what is the minimum value of the objective function $C = -2x - y$?

(A) -8 (B) 16 (C) -16 (D) 8

(0, −8) (4, 0) (16, 24)
$C = 8$ -8 $-32 - 24 = -56$



$\ln\frac{9}{5} = .08t$

$4500 = 2500e^{.08t}$ $\quad \frac{9}{5} = e^{.08t}$ $\quad A = Pe^{rt}$

2. Sally opened a savings account that earns 8% interest compounded continuously in order to save money for a $4500 car. So far Sally has saved $2500. How many years did it take for Sally to save enough money to buy the car if she did not add any more money to the account?

A. $x = \frac{\ln\left(\frac{9}{5}\right)}{.08}$ B. $x = \frac{.08}{\ln\left(\frac{9}{5}\right)}$ C. $x = \log_{1.08}\left(\frac{9}{5}\right)$ D. $x = \log_{\frac{9}{5}} 1.08$

3. Which of the following is equivalent to $e^{4x} = 2981$? $\ln 2981 = 4x$

A. $x = \frac{\ln 2981}{4}$ B. $x = \frac{4}{\ln 2981}$ C. $x = \frac{\ln 4}{2981}$ D. $x = \frac{2981}{\ln 4}$

4. Which of the following is equivalent to $2^{3x-4} = 32$? $\log_2 32 = 3x - 4$

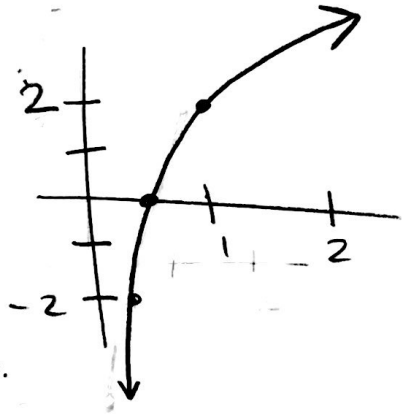
A. $x = \frac{\log_2 32}{3} + 4$ B. $x = \frac{\log_2 32 + 4}{3}$ C. $\log_2 3x - 4 = 32$

$\log_2 32 + 4 = 3x$

5. Given the function: $f(x) = 2\log_2(2x)$ horiz compress $\frac{1}{2}x$, vert stretch $2x$

$\log_2 x$: $(\frac{1}{2}, -1)$ $(\frac{1}{4}, -2)$ $(1, 0)$ $(\frac{1}{2}, 0)$ $(2, 1)$ $(1, 2)$

A. Sketch the graph



B. State the x-intercept?

$(\frac{1}{2}, 0)$

C. State the domain and range?

$\{x \mid x > 0\}$ $\quad \mathbb{R}$

D. Describe the end behavior as x approaches ∞.

$x \to \infty$

$y \to \infty$

Examples

1. Simplify $\sqrt{-8}$

$i\sqrt{8}$

$i\sqrt{4}\sqrt{2}$

$2i\sqrt{2}$

2. Simplify $\sqrt{-32}$

$i\sqrt{32}$

$i\sqrt{16}\sqrt{2}$

$4i\sqrt{2}$

3. Simplify $(-1+5i)+(-2-3i)$

$-3+2i$

4. Simplify $(3+2i)(2-5i)$

$6-15i+4i-10i^2$ (-1)

$16-11i$

5. What are the values of x and y when $(5+4i)-(x+yi)=(-1-3i)$?

A. x = 6, y = 7 C. x = 6, y = i

B. x = 4, y = i D. x = 4, y = 7

$5-x=-1$

$6=x$

$4i-yi=-3i$

$4-y=-3$

$7=y$

6. Which is equivalent to $(4-3i)^2+(6+i)^2$?

A. 30 B. 50 C. $42-12i$ D. $62-12i$

$16-24i+9i^2+36+12i+i^2$ (-1) (-1)

$42-12i$

7. For which equation is the x-coordinate of the vertex at 4?

A. $f(x)=x^2-8x+15$ $\frac{8}{2}=4$ C. $f(x)=x^2+6x+8$

B. $f(x)=-x^2-4x+12$ D. $f(x)=-x^2-2x+2$

vertex $x=\frac{-b}{2a}$

8. Adrian is using 120 feet of fencing to enclose a rectangular area for her puppy. One side of the enclosure will be her house. The function $f(x)=x(120-2x)$ represents the area of the enclosure. What is the greatest area that Adrian can enclose for fencing?

A. 1650 ft B. 1800 ft^2 C. 1980 ft D. 2140 ft

$y=-2x^2+120x$

(or)

put in calculator + find max!

max at vertex $x=\frac{-120}{2(-2)}=30$

$y=30(120-60)=1800\ ft^2$

omit 9. If $5 - 3i$ is a solution for $x^2 + ax + b = 0$, where a and b are real numbers, what is the value of b?

A. 10 B. 14 C. 34 D. 40

$(5-3i)(5+3i) = 25 - 9i^{(-1)} = 34$

10. The graph of the function x^3 will be shifted down 2 units and to the right 3 units. Which is the function that corresponds to the resulting graph?

A. $g(x) = (x+3)^2 + 2$ C. $g(x) = (x+3)^2 - 2$

B. $g(x) = (x-3)^2 + 2$ D. $g(x) = (x-3)^2 - 2$

11. Which choice shows the solutions to the function $8x^2 + 3x = -7$?

A. $\frac{-3 \pm i\sqrt{215}}{16}$ B. $\frac{3 \pm i\sqrt{215}}{16}$ C. $\frac{-3 \pm \sqrt{233}}{16}$ D. $\frac{3 \pm \sqrt{233}}{16}$

$8x^2+3x+7=0$

$x = \frac{-3}{2\cdot 8} \pm \frac{\sqrt{9-4\cdot 8\cdot 7}}{2\cdot 8}$

$\frac{-3}{16} \pm \frac{\sqrt{-215}}{16}$

12. What value of h is needed to complete the square for the equation

$x^2 + 10x - 8 = (x-h)^2 - 33$

$(x+5)^2$

A. -25 B. -5 C. 5 D. 25

13. The equation $2x^2 - 5x = -12$ is rewritten in the form of $2(x-p)^2 + q = 0$. What is the value of q?

A. $\frac{167}{16}$ B. $\frac{71}{8}$ C. $\frac{25}{8}$ D. $\frac{25}{16}$

$2\left(x^2 - \frac{5}{2}x + \frac{25}{16}\right) + 12\left(-\frac{25}{8}\right) = 0$

$2\left(x - \frac{5}{4}\right)^2 + \frac{71}{8}$

$\frac{96}{8} - \frac{25}{8}$

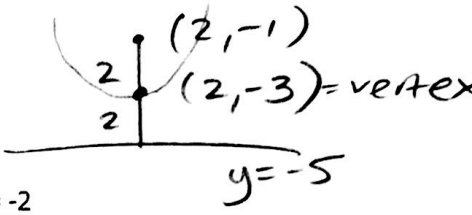
14. Which is an equation of a parabola what has a directrix of y = -5 and a focus at (2, -1)?

A. $y = \frac{1}{2}(x+2)^3 + 2$ C. $y = \frac{1}{8}(x+2)^3 + 3$

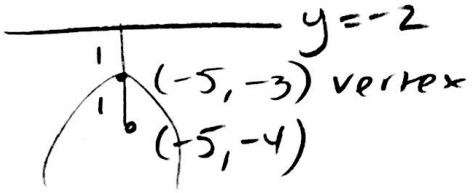
B. $y = \frac{1}{8}(x-2)^3 - 3$ D. $y = \frac{1}{2}(x-2)^3 - 2$

$p = 2$

$a = \frac{1}{4(2)} = \frac{1}{8}$



15. Find the equation of a parabola with a focus of (-5, -4) and a directrix of y = -2

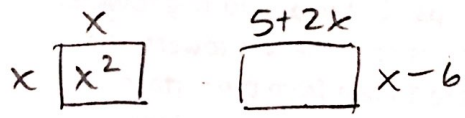


$p = 1$

$a = \frac{1}{4}$ down!

$y = -\frac{1}{4}(x+5)^2 - 3$

18. A square and a rectangle have the same area. The length of the rectangle is five inches more than twice the length of the side of the square. The width of the rectangle is 6 inches less than the side of the square. Find the length of the side of the square.



$x^2 = (5+2x)(x-6)$

$x^2 = 5x - 30 + 2x^2 - 12x$

$0 = x^2 - 7x - 30$

$(x-10)(x+3)$ $x=10$ ~~$x=-3$~~

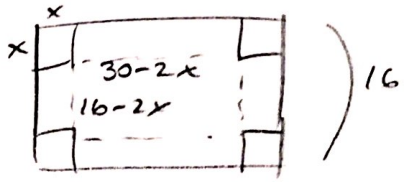
19. A cardboard box company has been contracted to manufacture open-top rectangular storage boxes for a manufacturing company. The company has 30 cm X 16 cm cardboard sheets. They plan to cut a square from each corner of the sheet and bend up the sides to form the box. If the company wants to make boxes with the largest possible volume:

- Find the dimensions of the square being cut out.

  $3\frac{1}{3} \times 3\frac{1}{3}$ cm
- What are the dimensions of the box?

  $3\frac{1}{3} \times 23\frac{1}{3} \times 9\frac{1}{3}$ cm
- What is the maximum volume of the box?

30 $0 < x < 8$



$V = x(30-2x)(16-2x)$ calc max $x = 3\frac{1}{3}$ cm

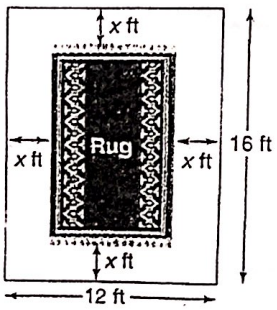
$V = 725.9\ cm^3$

20. A box with an open top will be constructed from a rectangular piece of cardboard.
- The piece of cardboard is 8 inches by wide and 12 inches long.
- The box will be constructed by cutting out equal squares of sides x at each corner and then folded up at the sides.

What is the entire domain for the function $V(x)$ that gives the volume of the box as a function of x?

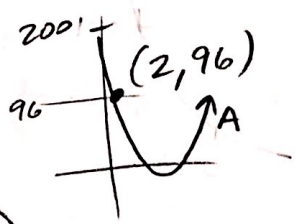
A. $0 < x < 4$ B. $0 < x < 6$ C. $0 < x < 8$ D. $0 < x < 12$

21. Abey Numkena is an interior designer. She has been asked to locate an oriental rug for a new corporate office. As a rule, the rug should cover $\frac{1}{2}$ of the total floor area with a uniform width surrounding the rug.



- If the dimensions of the room are 12 feet by 16 feet, write an equation to model the situation.

  $A = (16-2x)(12-2x) = 96$
- Sketch a graph of the function.



- What are the dimensions of the rug?

$x = 2$

8ft x 12ft

$16 \cdot 12 = 192$

$\frac{1}{2}(192) = 96 =$ rug area

2. The volume of a rectangular prism is represented by the expression $(x^3 - 2x^2 - 20x - 24)$. If the length is $(x - 6)$ and the height and width are equal, what is the width of the prism?

A. $x + 2$
B. $x - 2$
C. $x + 4$
D. $x - 4$

$$\begin{array}{c|cccc} & 1 & -2 & -20 & -24 \\ 6 & & 6 & 24 & 24 \\ \hline & 1 & 4 & 4 & 0 \end{array}$$

$(x-6)(x^2+4x+4)$
$(x-6)(x+2)(x+2)$
$\ell \quad w \quad h$

3. Suppose $p(x) = x^3 - 2x^2 + 13x + k$. The remainder of the division of $p(x)$ by $(x + 1)$ is -8. What is the remainder of the division of $p(x)$ by $(x - 1)$?

A. -8
B. 8
C. 16
D. 20

$$\begin{array}{c|cccc} & 1 & -2 & 13 & k \\ -1 & & -1 & 3 & -16 \\ \hline & 1 & -3 & 16 & -8 \end{array}$$

$k - 16 = -8$
$k = 8$

$$\begin{array}{c|cccc} & 1 & -2 & 13 & 8 \\ 1 & & 1 & -1 & 12 \\ \hline & 1 & -1 & 12 & 20 \end{array}$$

4. Which expression is the factored form of $x^3 + 2x^2 - 5x - 6$?

A. $(x + 1)(x + 1)(x - 6)$
B. $(x + 2)(2x - 5)(x - 6)$
C. $(x + 3)(x + 1)(x - 2)$
D. $(x - 3)(x - 1)(x + 2)$

put in calculator!

$$\begin{array}{c|cccc} & 1 & 2 & -5 & -6 \\ -1 & & -1 & -1 & 6 \\ \hline & 1 & 1 & -6 & 0 \end{array}$$

$(x+1)(x^2+x-6)$
$(x+1)(x+3)(x-2)$

5. What are the zeroes of the polynomial function $y = 2x^3 - 7x^2 + 2x + 3$? 1 in every answer!

A. $\frac{1}{2}, 1, 3$ B. -1, 1, 3 C. $-\frac{1}{2}, 1, 3$ D. $-3, \frac{1}{2}, 1$

$$\begin{array}{c|cccc} & 2 & -7 & 2 & 3 \\ 1 & & 2 & -5 & -3 \\ \hline & 2 & -5 & -3 & 0 \end{array}$$

6. Which polynomial function has zeroes at -4, 3, and 5?

A. $f(x) = (x + 4)(x + 3)(x + 5)$
B. $g(x) = (x + 4)(x - 3)(x - 5)$
C. $h(x) = (x - 4)(x - 3)(x - 5)$
D. $k(x) = (x - 4)(x + 3)(x + 5)$

$(x-1)(2x^2-5x-3)$
$(x-1)(2x+1)(x-3)$
$x = 1, -\frac{1}{2}, 3$

7. Which is not a factor of $x^3 - x^2 - 17x - 15$?

A. $x - 5$ B. $x + 1$ C. $x + 3$ D. $x + 5$

put in calculator!

$$\begin{array}{c|cccc} & 1 & -1 & -17 & -15 \\ 5 & & 5 & 20 & 15 \\ \hline & 1 & 4 & 3 & 0 \end{array}$$

8. Which of the following is not a solution of $x^4 - 3x^2 - 54 = 0$?

A. -3 B. 3 C. $-3i$ D. $-i\sqrt{6}$

put in calculator!

$$\begin{array}{c|ccccc} & 1 & 0 & -3 & 0 & -54 \\ -3 & & -3 & 9 & -18 & 54 \\ \hline & 1 & -3 & 6 & -18 & 0 \\ 3 & & 3 & 0 & 18 & \\ \hline & 1 & 0 & 6 & 0 & \end{array}$$

$(x-5)(x^2+4x+3)$
$(x-5)(x+3)(x+1)$

$(x+3)(x-3)(x^2+6)$
$x^2 = -6$
$x = \pm\sqrt{-6}$

omit

9. What is the expanded form of $(a-b)^3$?

A. $a^3+a^2b+ab^2+b^3$

B. $a^3+3a^2b+3ab^2+b^3$

C. $a^3-a^2b+ab^2-b^3$

D. $a^3-3a^2b+3ab^2-b^3$

10. The function f is defined as $f(x)=6x^4+x^3+4x^2+x-2$.

- Using the Remainder Theorem, determine if $\frac{1}{2}$ is a root of $f(x)$. Explain.

$\frac{1}{2}$	6	1	4	1	−2
		3	2	3	2
	6	4	6	4	0

yes

remainder = 0

- If i is also a root, what are the other two roots?

$-i$, $-\frac{4}{6} \neq -\frac{2}{3}$

$-i$

$x=\pm i=\pm\sqrt{-1}$

$x^2=-1$

$x^2+1=0$

$$x^2+0x+1 \overline{)6x^3+4x^2+6x+4}$$

$6x+4$

$-(6x^3+0x^2+6x)$

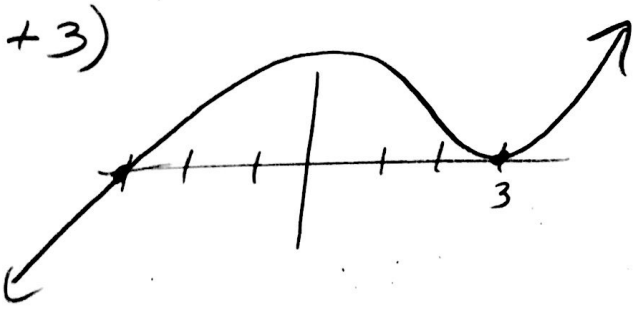
$4x^2+0x+4$

$-(4x^2+0x+4)$

0

11. For a certain polynomial function, x = 3 is a zero with multiplicity of two and x = -3 is a zero with a multiplicity of one. Write a possible equation for this function and sketch its graph.

$y=(x-3)^2(x+3)$



12. Is $(2x-3)^3-64$ equivalent to $(2x-11)(2x+5)$? Explain your reasoning.

No

cubic

x^3

quadratic

x^2

Math III Exponential/Geometric Series

Exponential functions are of the form $y = a(b)^x$, where a is the y-intercept or initial amount, and b is the growth/decay factor. If b is $b > 1$ it represents exponential growth and if $0 < b < 1$ it represents exponential decay.

Ex/ $f(x) = 5{,}236(1.08)^x$ *exponential growth, growth rate is 8%*
Ex/ $f(x) = 2{,}873(0.91)^x$ *exponential decay, decay rate is 9%*

Compounded interest uses the formula $A = p(1 + \frac{r}{n})^{nt}$, where p is the principle, r is the rate, t is the time, and n is the number of times the interest is compounded. (monthly $n = 12$, weekly $n = 52$, etc.)

Continuously compounded interest uses the formula $A = Pe^{rt}$, where p is the principle, r is the rate, and t is the time.

total payments, i is the monthly interest rate.

Sum of finite geometric series is found by $S_n = \frac{a_1(1-r^n)}{1-r}$, where a_1 is the first term, r is the ratio (what each term is multiplied by to get to the next), n is term number the series stops.

Examples:

1. 288, -96, 32,... What is the approximate value of the sum of the 7th term?

$a_1 = 288$ $\quad r = -\frac{1}{3}$ $\quad S_7 = \frac{288\left(1-\left(-\frac{1}{3}\right)^7\right)}{1-\left(-\frac{1}{3}\right)} = 216.1$

2. 360 + 480 + 640 + ... What is the approximate value of the sum of the 15th term?

$a_1 = 360$ $\quad r = \frac{4}{3}$ $\quad S_{15} = \frac{360\left(1-\left(\frac{4}{3}\right)^{15}\right)}{1-\left(\frac{4}{3}\right)} = 79737.4$

3. What is the approximate value of the sum:

$8 - \frac{8}{7} + \frac{8}{49} - \cdots 8 \cdot \left(\frac{-1}{7}\right)^{2500}$? $\quad n = 2500$ $\quad r = -\frac{1}{7}$

$S_{2500} = \frac{8\left(1-\left(-\frac{1}{7}\right)^{2500}\right)}{1-\left(-\frac{1}{7}\right)} = 8$

omit

4. Find the monthly payment of $175,000 home on a 30 year mortgage with a 3.5% interest rate.

5. Angela deposited $3000 into a savings account earning 4% interest compounded continuously, how much will she have after 6 years?

$A = Pe^{rt}$

$A = 3000e^{.04(6)} = \$3813.75$

6. Sam deposited $5,500 into a savings account earning 5.6% interest compounded monthly. How many years had he been saving when the savings account has a balance of $8599.52?

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

$8599.52 = 5500\left(1 + \frac{.056}{12}\right)^{12t}$

$1.56 = (1.0047)^{12t}$

$\log_{1.0047} 1.56 = 12t \quad 12t = \frac{\log 1.56}{\log 1.0047} = 96$

$t = 8$ yrs

7. Mary wants a dress that costs $450 for the prom. So far she has saved $275 and put it in a savings account for 1.5 years, what interest rate must she earn to have $450 by prom?

$450 = 275e^{r(1.5)}$

$1.64 = e^{1.5r}$

$\ln 1.64 = 1.5r$

$.328 = r \quad 32.8\%$

8. A board is made up of 9 squares. A certain number of pennies is placed in each square, following a geometric sequence. The first square has 1 penny, the second has 2 pennies, the third has 4 pennies, etc. When every square is filled, how many pennies will be used in total?

A. 521 B. 511 C. 256 D. 81

$1, 2, 4, 8, 16, \ldots \quad r = 2$

$S_9 = \frac{1(1-2^9)}{1-2} = 511$

$$2x - 2(x-1) = x(x-1)$$

$$2x - 2x + 2 = x^2 - x$$

$$0 = x^2 - x - 2$$

Step 3: Solve for x

$$0 = (x-2)(x+1)$$

So $x = 2$ *and* $x = -1$

Step 4: Plug answers back into the original equation and check for extraneous solutic

$\frac{2}{2-1} - 1 = \frac{2}{2}$ $\qquad$ $\frac{-1}{-1-1} - 1 = \frac{-1}{1}$

$1 = 1$ $\qquad$ $-\frac{1}{2} \neq -1$

So x = 2 is a solution $\qquad$ So x = -1 is **not** a solution

The solution -1 is an **extraneous solution**

Examples:

1. Solve for x: $\frac{x+1}{5} - 2 = \frac{-4}{x}$ $\quad 5x \quad 5x$

   A. x = 4

   B. x = 5

   C. x = 4, 5

   D. no solution

Common denom: $5x$

$x(x+1) - 10x = -20$

$x^2 + x - 10x = -20$

$x^2 - 9x + 20 = 0$

$(x-4)(x-5) = 0$

$x = 4, 5$ check!

2. Solve for x: $\frac{8}{x-5} - \frac{9}{x-4} = \frac{5}{x^2-9x+20}$

$(x-5)(x-4)$ $(x-5)(x-4)$ $(x-5)(x-4)$

condenom $(x-5)(x-4)$

$8(x-4) - 9(x-5) = 5$

$8x - 32 - 9x + 45 = 5$

$8 = x$ check!

3. Solve for x: $8 - \sqrt{x+12} = 3$

$(5)^2 = (\sqrt{x+12})^2$

$25 = x + 12$

$13 = x$ check:

4. Solve for x: $(\sqrt{x+15})^2 = (5+\sqrt{x})^2$ $(5+\sqrt{x})(5+\sqrt{x})$

$x + 15 = 5 + 10\sqrt{x} + x$

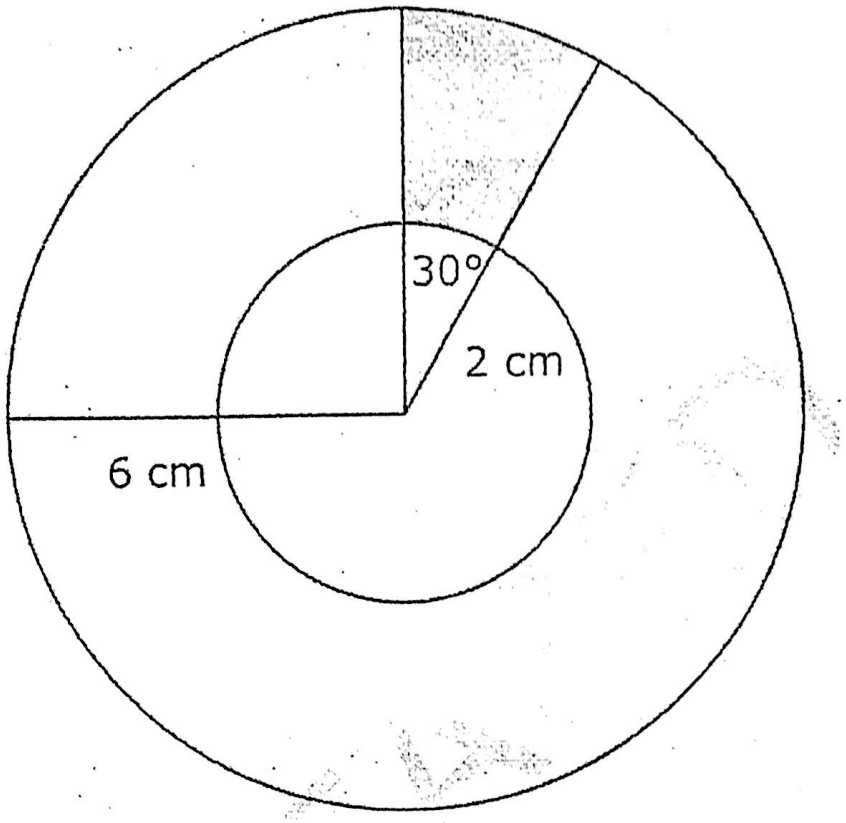
$-x \quad -5 \quad -5 \quad -x$

$10 = 10\sqrt{x}$

$(1)^2 = (\sqrt{x})^2$

$1 = x$ check! $\sqrt{16} = 5 + \sqrt{1}$ X

6. In the figure below, the larger circle has a radius of 6 cm, and the smaller circle has a radius of 2 cm.



What is the ***approximate*** area of the shaded region?

A 2.1 cm²

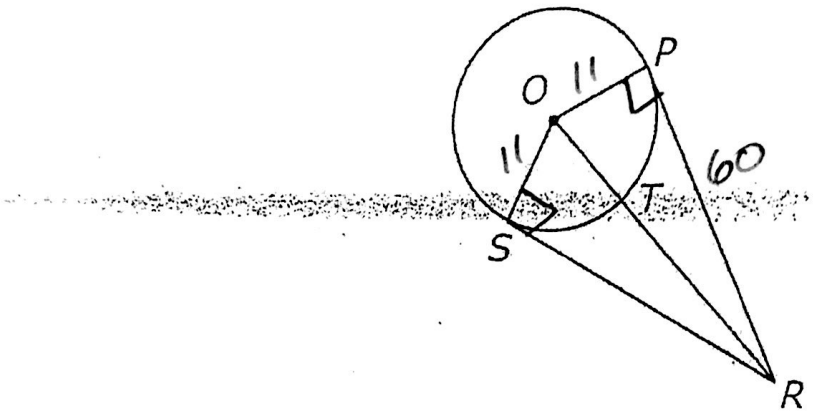
B 3.4 cm²

C 4.2 cm²

D 8.4 cm²

$\frac{30}{360}\pi \cdot 6^2 - \frac{30}{360}\pi \cdot 2^2$

7. In the figure below, $\overline{PR}$ and $\overline{SR}$ are tangent to circle O.



If $OT = 11$ cm and $PR = 60$ cm, what is the length of $\overline{OR}$?

A 61 cm

B 59 cm

C 50 cm

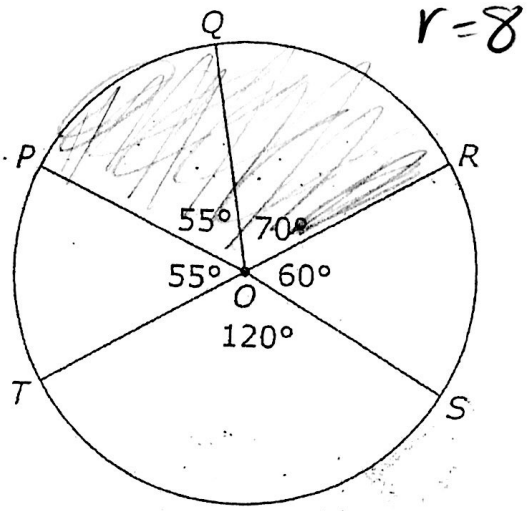
D 48 cm

$11^2 + 60^2 = OR^2$

$3721 = OR^2$

$61 = OR$

8. $\overline{TR}$ is a diameter of circle O and has a length of 16 ft.



$r = 8$

What is the ***approximate*** area of the sector bounded by $\angle POR$ and $\overset{\frown}{PQR}$?

A $70\ ft^2$

B $67\ ft^2$

C $42\ ft^2$

D $39\ ft^2$

$\frac{125}{360} \pi \cdot 8^2$

9. Derive the standard equation of the circle $x^2 + y^2 + 4x - 6y = -4$

$x^2 + 4x$ [+4] $y^2 - 6y$ [+9] $= -4$ [+4] [+9]

$(x+2)^2 + (y-3)^2 = 9$

10. Which is the equation of a circle with center (-2, 3) and a radius r = 5?

A. $(x+2)^2 + (y-3)^2 = 10$

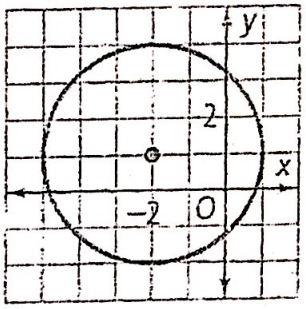
B. $(x+2)^2 + (y-3)^2 = 25$

C. $(x-2)^2 + (y+3)^2 = 10$

D. $(x-2)^2 + (y+3)^2 = 25$

11. Which of the following is the graph of $(x-2)^2 + (y+1)^2 = 9$

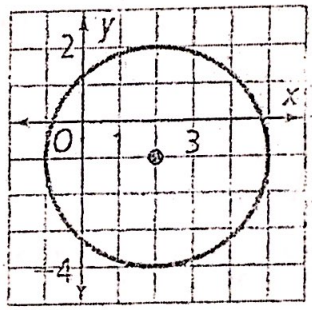
A.



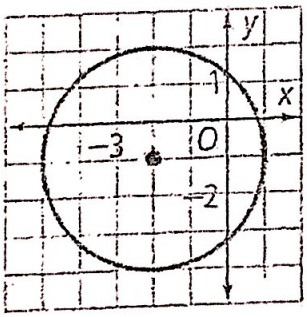
(2, -1)

r = 3

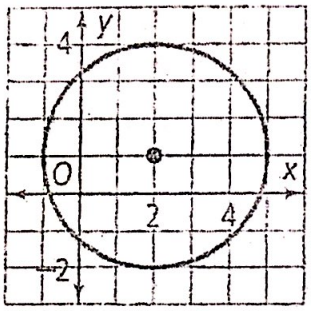
C.



B.



D.



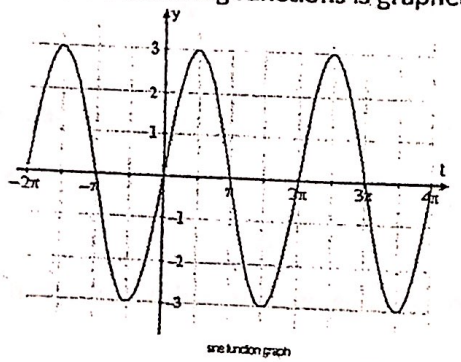
4. William put the tip of his pencil on the outer edge of a graph of the unit circle at the point (0, -1). He moved this pencil tip through an angle of $\frac{4\pi}{3}$ radians in the counterclockwise direction along the edge of the circle. At what angle of the unit circle did William's pencil tip stop?

$\frac{4\pi}{3} = 240°$

A. $\frac{\pi}{3}$ B. $\frac{5\pi}{6}$ C. $\frac{7\pi}{6}$ D. $\frac{5\pi}{3}$

$\frac{1}{2}\odot = \frac{3\pi}{3}$

5. Which of the following functions is graphed below?



sine function graph

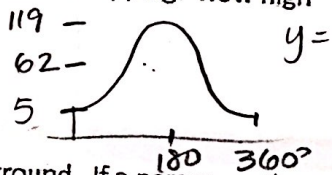
A. $y = 3\cos\theta$ B. $y = 3\sin\theta$ C. $y = \cos 3\theta$ D. $y = \sin 3\theta$

6. A Ferris wheel has a diameter of 114 feet and is 5 feet off the ground. After a person gets on the bottom car, the Ferris wheel rotates 170° counterclockwise before stopping. How high above the ground is the car when it has stopped?

$r = 57$

A. 56 feet B. 62 feet C. 80 feet D. 118 feet

almost at the top



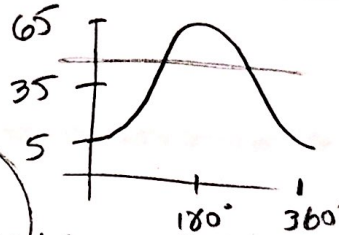
$y = -57\cos\theta + 62$

7. A Ferris wheel has a radius of 30 meters and is 5 meters off the ground. If a person on the Ferris wheel is 50 meters above the ground, at what degree(s) had the Ferris wheel rotated counterclockwise?

$-30\cos\theta + 35 = 50$

$-30\cos\theta = 15$

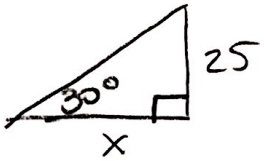
$\cos\theta = -\frac{1}{2}$ $\theta = 120°$ or $240°$



$y = -30\cos\theta + 35$

8. A rope is attached to the top of a 25-foot pole. The pole is perpendicular to the ground. Approximately how far from the base of the pole must the rope be attached to make a 30° angle with the ground?

A. 12.5 feet B. 14.4 feet C. 43.3 feet D. 50.0 feet

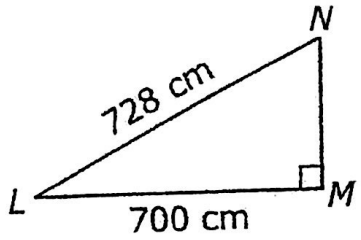


$\frac{\tan 30}{1} = \frac{25}{x}$

$x\tan 30 = 25$

$x = \frac{25}{\tan 30} = 43.3$ ft

9. In right triangle *LMN*, *LN* = 728 cm and *LM* = 700 cm.



What is the ***approximate*** measure of ∠*NLM*?

A 15.9°

~~B 16.6°~~

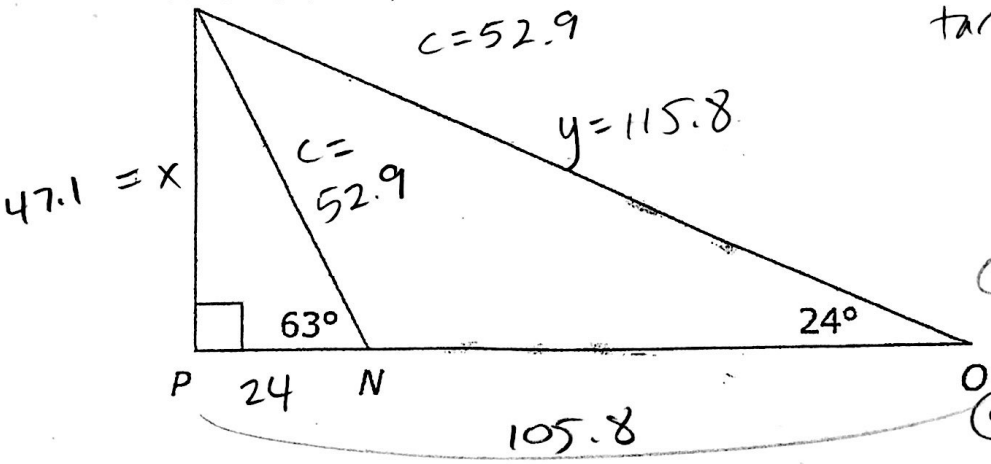
C 73.4°

D 74.1°

$\cos L = \frac{700}{728}$

$\cos^{-1}\left(\frac{700}{728}\right) = 15.9°$

10. In the diagram below, Triangle *MPO* is a right triangle and $\overline{PN} = 24$ ft.



(b) $24^2 + 47.1^2 = c^2$

$c = 52.9$

$\tan 63 = \frac{x}{24}$

$x = 47.1$

(a) $\tan 24 = \frac{47.1}{PO}$

(c) $PO \tan 24 = 47.1$

$PO = \frac{47.1}{\tan 24} = 105.8$

$105.8 - 24 = 81.8$

(a) What is the length of $\overline{MP}$? 47.1 ft

(b) How much longer is $\overline{MO}$ than $\overline{NM}$? 62.9 ft

(c) How far is point *O* from point *N*? 81.8 ft

$\sin 24 = \frac{47.1}{y}$

(b)

$y \sin 24 = 47.1$

$y = \frac{47.1}{\sin 24} = 115.8$

$115.8 - 52.9 = 62.9$ ft

OMIT

11. Which expression is equivalent to $\frac{sin^4(\theta)-cos^4(\theta)}{sin^2(\theta)-sin^2(\theta)}$, where $sin^2(\theta) \neq cos^2(\theta)$?

error

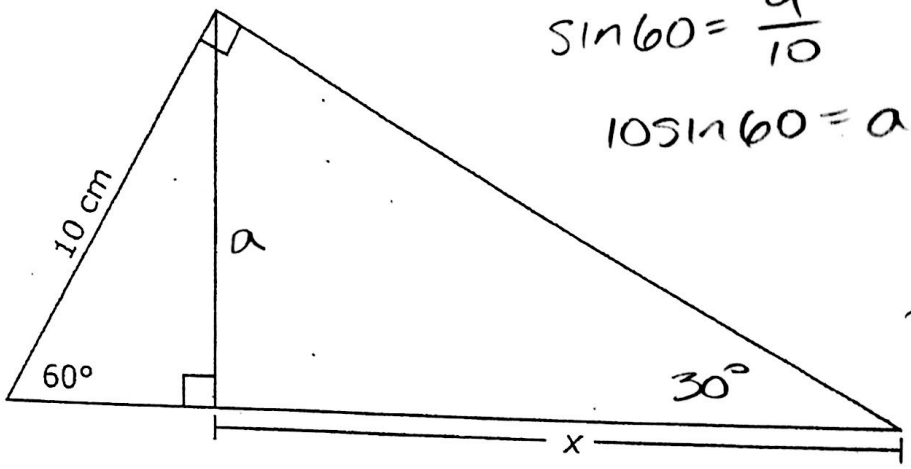
A. $sin^2(\theta) - cos^2(\theta)$

B. $cos^2(\theta) - sin^2(\theta)$

C. 2

D. 1

12. What is the value of x in the triangle below?



$\sin 60 = \frac{a}{10}$

$10 \sin 60 = a = 5\sqrt{3}$

≈ 8.66

$\tan 30 = \frac{8.66}{x}$

$x \tan 30 = 8.66$

$x = \frac{8.66}{\tan 30} = 15$ cm

A. $\frac{5\sqrt{3}}{2}$ cm B. $5\sqrt{3}$ cm C. 10 cm D. 15 cm

13. Which angle, in standard position, is NOT coterminal with the others?

A. -190^0 $+360$ 170

B. -170^0 $+360$ 190

C. 190^0 $+360$ 550

D. 550^0

14. The diameter of a circle is 8 centimeters. A central angle of the circle intercepts an arc of 12 centimeters. What is the radian measure of the angle?

$r = 4$

A. $\frac{3}{2}$ B. 3 C. 4 D. 8π

$s = \theta r$

$12 = \theta \cdot 4$

$3 = \theta$

84

15. In a circle, an arc of length 8π cm is intercepted by a central angle of $\frac{2\pi}{3}$ radians. What is the radius of the circle?

A. $\frac{3\pi}{16}$ cm B. $\frac{16\pi}{3}$ cm C. $\frac{16\pi^2}{3}$ cm D. 12 cm

$S = \theta r$

$8\pi = \frac{2\pi}{3} r$; $24 = 2r$

$12 = r$

16. What is the amplitude of $y = 3\sin 4\theta$?

A. $\frac{4}{3}$ B. 3 C. 4 D. 2π

17. Which answer choice describes $y = -\sin 2\theta$? $P = \frac{2\pi}{2} = \pi$

A. amplitude -1, period 4π B. amplitude 1, period π

C. amplitude 2, period $-\pi$ D. amplitude 2π, period 1

18. Which function has a period of 4π and an amplitude of 8? $B = \frac{2\pi}{4\pi} = \frac{1}{2}$

A. $y = -8\sin 8\theta$ B. $y = -8\sin\frac{1}{2}\theta$ C. $y = 8\sin 2\theta$ D. $y = 4\sin 8\theta$

19. Which function is a phase shift of $y = \sin\theta$ by 5 units to the left?

A. $y = 5\sin\theta$ B. $y = \sin\theta + 5$ C. $y = \sin(\theta + 5)$ D. $y = \sin 5\theta$

1. A town has 685 households. The number of people per household is normally distributed with a mean, μ, of 3.67 and a standard deviation, σ, of 0.34. ***Approximately*** how many households have between 2.99 and 4.01 people?

normalcdf(2.99, 4.01, 3.67, 0.34) = .8186

A. 493 households B. 520 household C. 558 households D. 575 households

.8186(685) = 561

2. A student wants to determine the most liked professor at her college. Which type of study would be the most ***practical*** to obtain this information?

A. a simulation B. an experiment C. a survey D. an observation

3. A principal wants to survey 150 students to determine which electives to offer during the next school year. There are 1,800 students in the school. Which procedure could the principal use to select a sample using a systematic random sample?

A. Obtain a list of all students. Start with the eighth student, and select every twelfth student until 150 students have been selected.

B. Select the first 150 students who enter the school.

C. Choose the fifth student to come to the cafeteria, and then select every third student who comes into the cafeteria until 150 students have been selected.

↗ location = convenience

D. Place students' names on the slips of paper and select 150 slips.

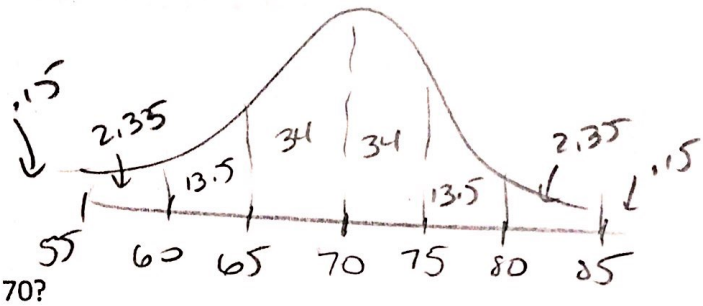
4. 2000 freshman at State University took a math test. The scores were distributed normally with a mean of 70 and a standard deviation of 5.

a) What percent of scores were between 60and 75?

80.5%

b) What percent of those scores were between 75 and 80?

13.5%



c) Approximately how many students scored between 65 and 70?

.34(2000) = 680

5. A sample has a mean of 85 and a standard deviation of 2. Find the z-score of an observation of 82 and explain where it is located on the normal distribution.

$z = \frac{82-85}{2} = -1.5$ 1.5 Standard deviations below the mean

6. A reporter want to know the percentages of voters in the state who support building a new highway. What is the reporter's population?

A. The number of people who live in the state

B. The people who were interviewed in the stat

C. The voters over 25 years old in the state

D. All eligible voters in the state

$\bar{x} + s = 88$
$\bar{x} - 3s = 76$ $\frac{12}{4} = 3 = s$

7. In a set of test scores that are normally distributed, a test score of 76 is 3 standard deviations below the mean. A score of 88 is 1 standard deviation above the mean. What is the mean of the data?

A. 79 B. 82 C. 84 D. 85

8. A survey of 2580 students found that 9% are left-handed.

- Find the margin of error for the sample $\frac{1}{\sqrt{2580}} = .02 = \pm 2\%$
- Use the margin of error to find an interval that is likely to contain the true population proportion

$9\% \pm 2\% = 7-11\%$