The function $P(t) = 300e^{(0.038t)}$ models the number of bacteria in a population after t minutes.

- What is the meaning of the coefficient of e in the context of the problem?
- What is the meaning of the coefficient of t in the context of the problem?

- 300 is the initial value when $t=0$
- Bacteria is growing 3.8% per minute.

A person is on a ride at a carnival. The table below shows approximately how high the person is off the ground after t seconds.

Seconds (t)	Feet off the Ground (h)
0	3
10	14
20	25
30	33
40	25
50	14
60	3

- Write an equation of the sine function that *best* fits the data.
- What is the meaning of the constant term in the equation you derived?

Scientists estimated the number of mosquitoes living in an area in different years.

Year	Mosquitoes (in thousands)
1960	6
1970	8
1980	12
1990	18
2000	34
2010	42

The scientists then decided to use an exponential best-fit model to predict the number of mosquitoes that will be in the area in 2020.

- Write an equation that the scientists used to make their prediction.
- Use your equation to predict how many mosquitoes will be living in the area in 2020?

$y = 5.57(1.0422)^x$

2020 when $t=60$

66.6 thousand mosquitoes

A window maker uses the graph of a rose curve to create a pattern in stained glass.

- If the window maker uses the equation $r = 8\cos 4\theta$ to represent the curve, what is the maximum petal length?
- How many petals does the graph have?
- Explain your answers.

→ Since n is even, you need to double it to get 8 petals.

→ The maximum petal length is 8, because 8 is "a" or the lead coefficient

Key

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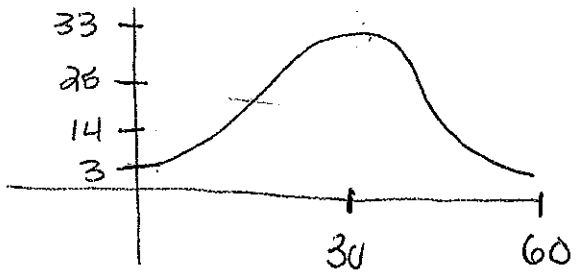


Total height $33-3=30$, so Amplitude $=15$

Midline is 15 from maximum, so $33-15=18$
or 15 from minimum, so $3+15=18$

$y=18$ midline

Period $=60$

In degrees $\frac{360}{B}=60$

$B=6$

In Radians $\frac{2\pi}{B}=60$

$B=\frac{\pi}{30}$

Sine must start on the midline.
So Phase Shift right 15.

$\frac{-C}{B}=$ Phase Shift

$\frac{-C}{6}=15$ $-C=90$ $C=-90$ (Degrees)

$\frac{-C}{\frac{\pi}{30}}=15$ $-C=\frac{\pi}{2}$ $C=\frac{-\pi}{2}$ (radians)

$y=15\sin(6\theta-90)+18$

$y=15\sin\left(\frac{\pi}{30}\theta-\frac{\pi}{2}\right)+18$

- The constant, 18, represents the midline of the sine function.

The chart below shows the amount of insulin in a person's bloodstream after a certain amount of time, t.

t (minutes)	3	15	24	45
Units of Insulin	8.6	4.9	3.1	1.0

Create a best fit exponential function to answer the questions.

- To the nearest tenth, how many units of insulin are in the person's bloodstream at $t = 0$?
- To the nearest percent, what is the absolute value of the percent change per minute of insulin?

$y = 10.36(.9498)^x$

At $t=0$, 10.36 units of insulin

Decrease of 5.02% percent

A geologist is analyzing the erosion of a coastline over the past five years. The table below shows the relationship.

Time (years)	1	2	3	4	5
Cumulative Erosion (feet)	1.01	2.81	6.51	10.14	16.32

- Does a linear, exponential, or power function best fit the data? Explain.
- Write the equation of the function that best models the data.
- Using the equation created, how much erosion can be expected after 8 years?

Check r values

Linear $r = .9806$

Exponential $r = .9824$

Power $r = .9977$

Power Function is better

$y = .949x^{1.73}$

After 8 years, 34.6 ft of erosion

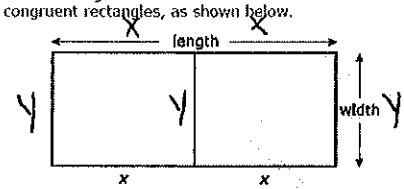
Use the piecewise function below to answer each question.

$$h(x) = \begin{cases} -2x^4 + 5x + 10 & \text{for } -4 \le x < 3 \quad \text{Step 1} \\ 3x + 2 & \text{for } 3 \le x < 7 \quad \text{Step 2} \\ \sqrt{2x - 5} & \text{for } 7 \le x < 16 \quad \text{Step 3} \end{cases}$$

- What is the range for step 1?
- What is the domain for the entire function?
- What is $h(10.5)$?

- $-42 \le y \le 13.125$ $[-42, 13.125]$
- $-4 \le x < 16$ $[-4, 16)$
- $\sqrt{2(10.5)-5} = \boxed{4}$

A farmer has 600 yards of fence. He will use some of the fence to enclose a rectangular area. He will use the rest to divide the area into two congruent rectangles, as shown below.



- What is the value of x that results in the largest area?
- What is the largest area that the farmer can enclose?
- What are the length and the width of the outer fence that will produce the largest total area?

$4x + 3y = 600$ $\quad y = \frac{600 - 4x}{3}$

$\text{Area(big Rectangle)} = (2x)\left(\frac{600-4x}{3}\right)$

$A = \frac{1200x - 8x^2}{3}$

1) $x = 75$ gives largest area

2) Max Area = 15,000 yd^2

3) 150 x 100

Suppose that Kyle has $1,500 to invest. His investment will earn an interest rate of 8.25% compounded continuously.

- To the nearest cent, what will be the value of Kyle's investment after 6 years?
- To the nearest tenth, how long will it take for Kyle's investment to grow to $3,000?
- To the nearest tenth, what interest rate would be needed to triple Kyle's investment in 15 years?

$y = Pe^{rt}$ $y = 1500e^{.0825t}$

After 6 years

$y = 1500e^{(.0825 \cdot 6)}$

$\$2460.75$

- $1500e^{.0825t} = 3000$

$e^{.0825t} = 2$

$\ln e^{.0825t} = \ln 2$

$.0825t = .693147$

$t = 8.4$ years

- $1500e^{15 \cdot r} = 4500$

$e^{15r} = 3$

$15r = \ln 3$

$r = .0732$

7.32% interest rate

The function $f(t) = 36(0.50)^{\frac{1}{5730}t}$ models the amount of carbon-14, in mg, remaining in a sample t years after the year 1200.

- What amount of carbon-14 was present in the sample in the year 1200?
- What is the meaning of the coefficient of t in the context of the problem?

$y = 36(.5)^{\frac{1}{5730}t}$

- The year 1200 is the initial amount (when $t=0$) so 36 mg
- $\frac{1}{5730}$ means that it takes 5730 years to go through one cycle (one half life)

The general equation of an ellipse is shown below.

$$9x^2 - 54x + 25y^2 - 100y - 44 = 0$$

- Write an equivalent standard equation for the ellipse.
- Describe what the coefficients of x^2 and y^2 in the standard equation tell about this ellipse.

$9(x^2 - 6x + \_\_) + 25(y^2 - 4y + \_\_) = 44$

$9(x^2 - 6x + 9) + 25(y^2 - 4y + 4) = 44 + 81 + 100$

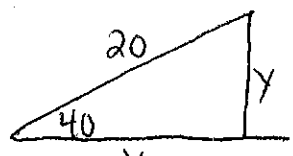
$9(x-3)^2 + 25(y-2)^2 = 225$

$\frac{(x-3)^2}{25} + \frac{(y-2)^2}{9} = 1$

This is a horizontal ellipse whose major axis is 10 and the minor axis is 6.

A child is pulling a sled through the snow with a force of 20 Newtons at an angle of 40°.

- To the nearest tenth, what is the vertical component of the force?
- To the nearest tenth, what is the horizontal component of the force?



Vertical component

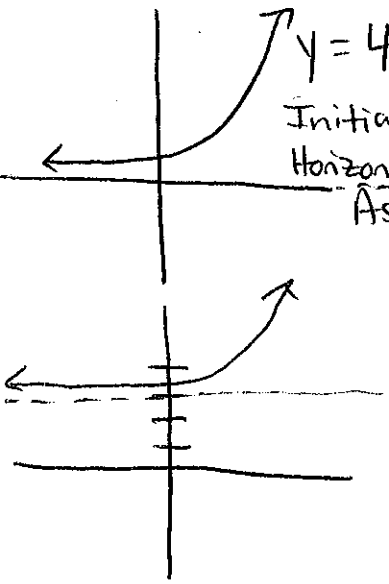
$y = 20\sin 40 = \boxed{12.86 \text{ N}}$

Horizontal Component

$X = 20\cos 40 = \boxed{15.32 \text{ N}}$

Let $f(x) = 4^x$.

- Graph $f(x - 2) + 3$.
- Write a description of the transformation that occurred.



$y = 4^x$

Initial Value = 1

Horizontal Asymptote $y = 0$

$y = 4^{x-2} + 3$

Initial value $= \frac{49}{16}$ (when $x = 0$)

Horiz. Asymptote $y = 3$

The equation $y = \frac{1}{18}x^2$ represents the mirror inside a parabolic lamp.

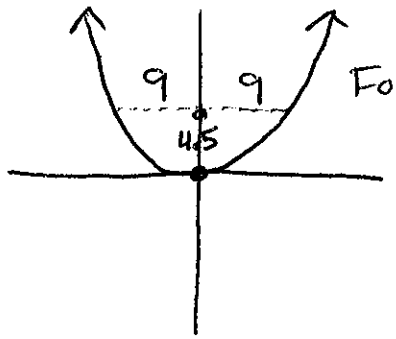
- What is the focal width of the mirror?
- Use the equation to explain your answer.

$a = \frac{1}{4c}$ where c is the distance to focus

$\frac{1}{18} = \frac{1}{4c}$

$4c = 18$

$c = 4.5$



Focal width = $9 + 9 = 18$

The function $P(t) = 1,440e^{-0.0259t}$ models the number of cars a dealership sold t years after the first year it was open.

- By what percent is the number of cars being sold decreasing each year?
- How many cars did the dealership sell the year it opened?

$y = 1440e^{-.0259t}$

Decrease 2.59% per year

When $t = 0$, 1440 cars

Two parametric equations are shown below.

$$x = \frac{3t^2}{2}$$

$$y = 4t - 1$$

- Convert the parametric equations into rectangular form.
- Determine what type of equation the rectangular form describes.

$x = \frac{3t^2}{2}$

$2x = 3t^2$

$\frac{2x}{3} = t^2$

$\pm\sqrt{\frac{2x}{3}} = t$

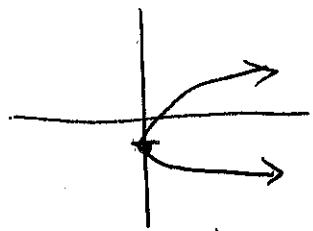
or

$\pm\frac{\sqrt{6x}}{3} = t$

$y = 4\left(\pm\frac{\sqrt{6x}}{3}\right) - 1$

$y = \pm\frac{4\sqrt{6x}}{3} - 1$

$y = \pm\frac{4\sqrt{6x} - 3}{3}$



Horizontal Parabola