Name Schlansky
Mr. Schlansky

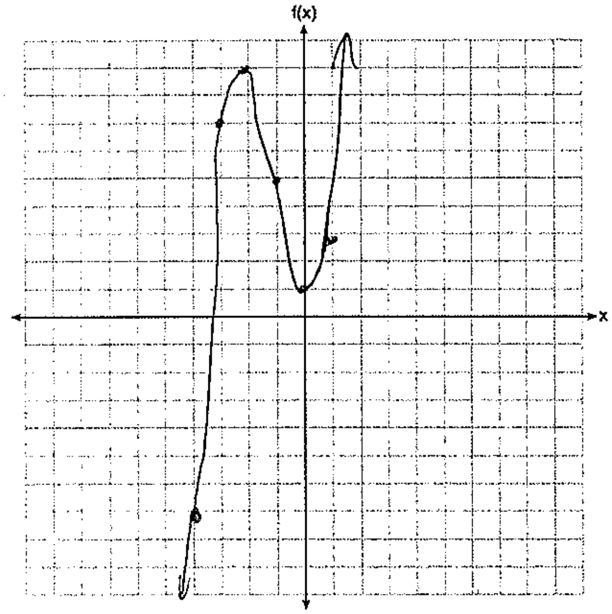
Date ____________
Algebra II

Graphing Functions

Graph the following equations on the grid provided

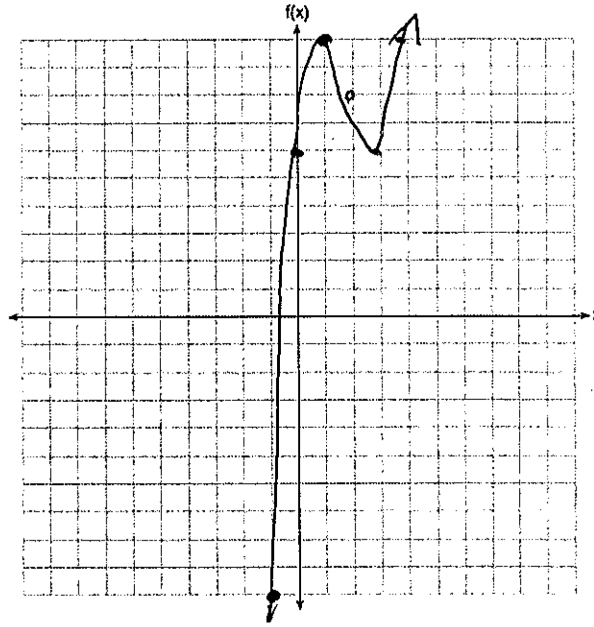
1. $p(x) = x^3 + 3x^2 - 2x + 1$

X	y
-4	-7
-3	7
-2	9
-1	5
0	1
1	3



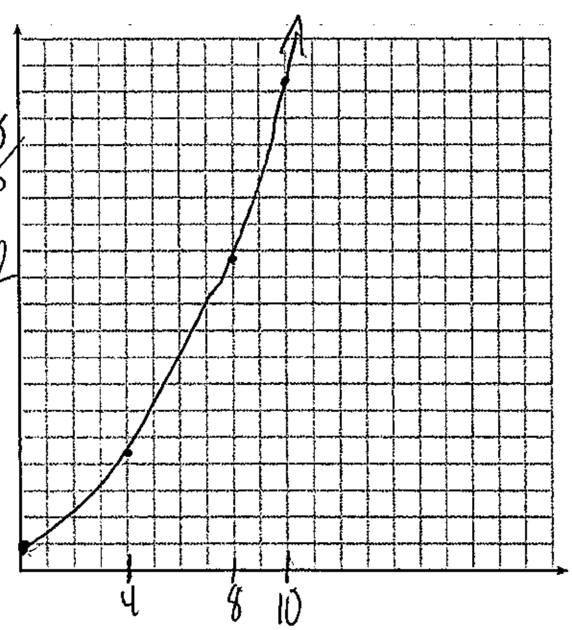
2. $f(x) = x^3 - 6x^2 + 9x + 6$

X	y
-1	-10
0	6
1	10
2	8
3	6
4	10



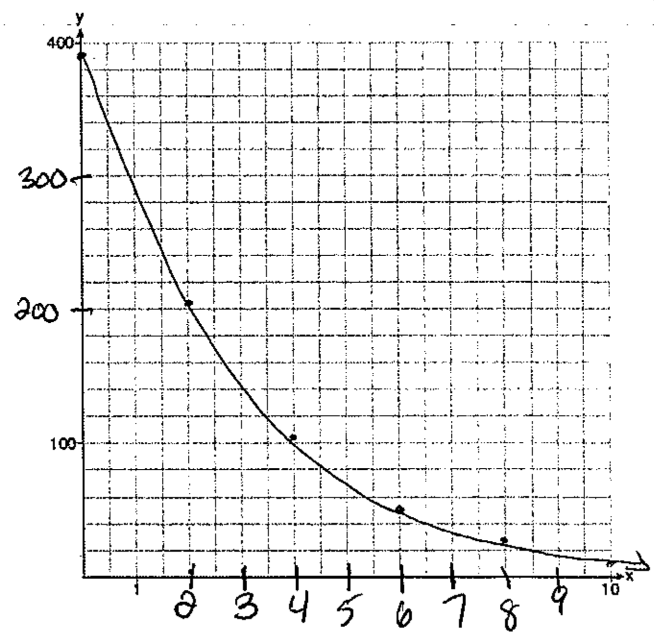
3. $f(x) = 3(1.21)^x - 2$

X	y
0	1
4	4.4308
8	11.785
10	18.182



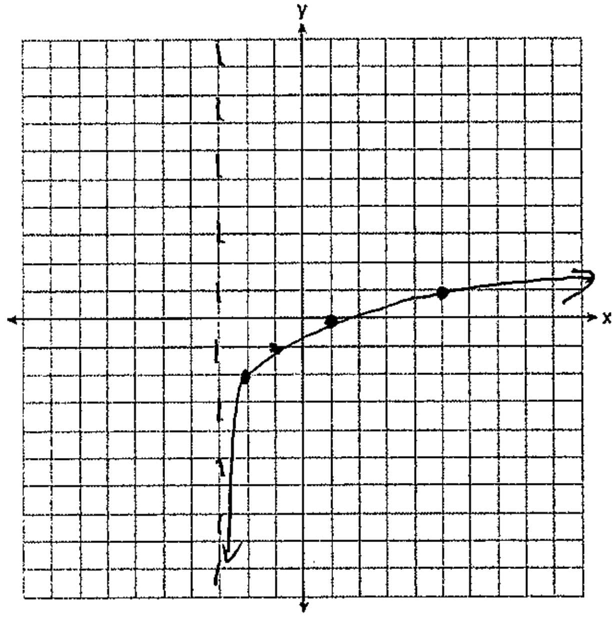
4. $y = 400(.85)^{2x} - 6$

X	y
0	394
2	202.8
4	103
6	50.89
8	23.7
10	15.45

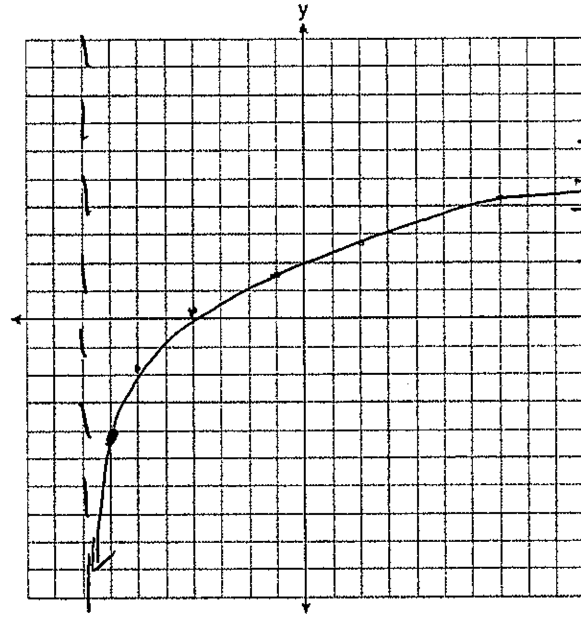


5. $f(x)=\log_2(x+3)-2$

x	y
-2	-2
-1	-1
1	0
5	1

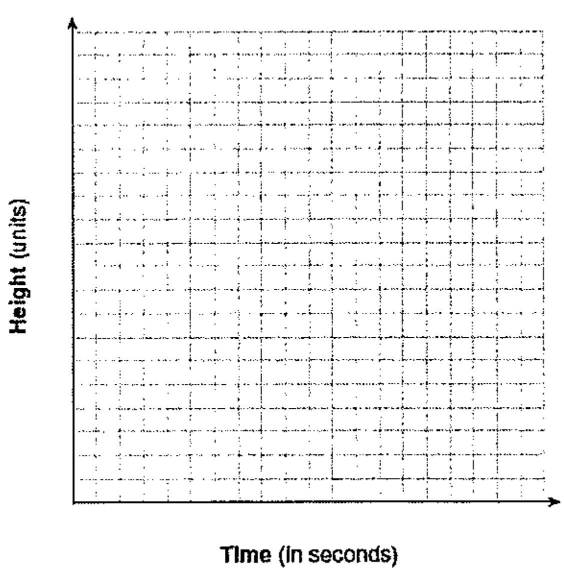


6. $f(x)=3\ln(x+8)-4$



x	y
-7	-4
-6	-1.9
-4	.16
-1	1.8
2	2.9
7	4.1

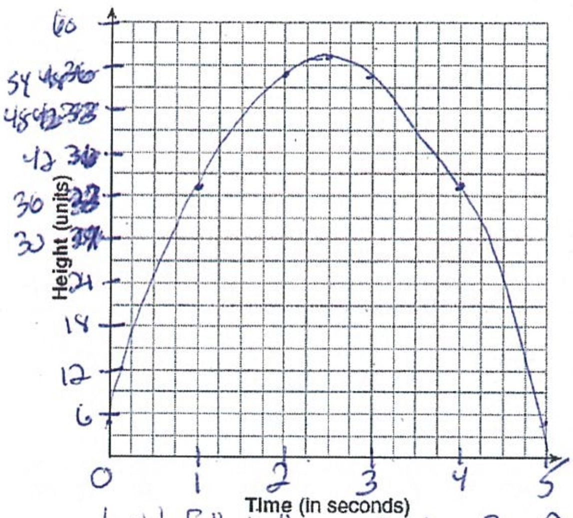
7. Alex launched a ball into the air. The height of the ball can be represented by the equation $h=-8t^2+40t+5$, where h is the height, in units, and t is the time, in seconds, after the ball was launched. Graph the equation from $t=0$ to $t=5$ seconds.
State the coordinates of the vertex and explain its meaning in the context of the problem.



x	y
0	
1	
2	
3	
4	
5	

7. Alex launched a ball into the air. The height of the ball can be represented by the equation $h = -8t^2 + 40t + 5$, where h is the height, in units, and t is the time, in seconds, after the ball was launched. Graph the equation from $t = 0$ to $t = 5$ seconds.
State the coordinates of the vertex and explain its meaning in the context of the problem.

X	y
0	5
1	37
2	53
3	53
4	37
5	5



Scale

$x \geq \frac{5}{20}$ $\quad y \geq \frac{55}{20}$

$x \geq .25$ $\quad y \geq 2.75$

$x = .25$ $\quad y = 3$

*2nd Trace: maximum

(2.5, 55)

time in seconds, height in units

The maximum height of the ball is 55 units after 2.5 seconds

8. Paul plans to have a rectangular garden adjacent to his garage. He will use 36 feet of fence to enclose three sides of the garden. The area of the garden, in square feet, can be modeled by $f(w) = w(36 - 2w)$, where w is the width in feet. On the set of axes below, sketch the graph of $f(w)$.

X	y
0	0
4	112
8	160
12	144
16	64
18	0

$\frac{40}{4} = 10$

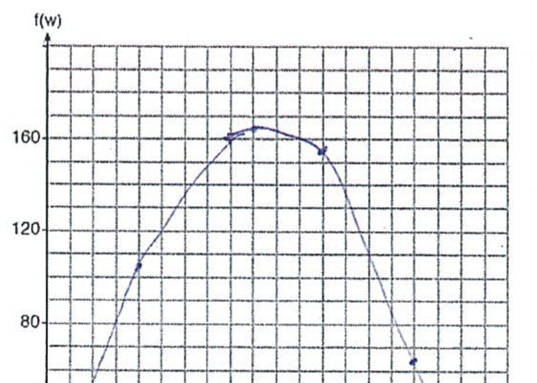


table going from 0 to 20

*2nd Trace: maximum

(9, 162)

width in feet, area of the garden in square ft

Explain the meaning of the vertex in the context of the problem.

The maximum area of the garden is 162 sq ft when the width is 9 feet.

9. John and Sarah are each saving money for a car. The total amount of money John will save is given by the function $f(x) = 60 + 4x$ The total amount of money Sarah will save is given by the function $g(x) = x^2 + 46$. To the nearest tenth of a week, after how many weeks, x, will they have the same amount of money saved? Explain how you arrived at your answer.

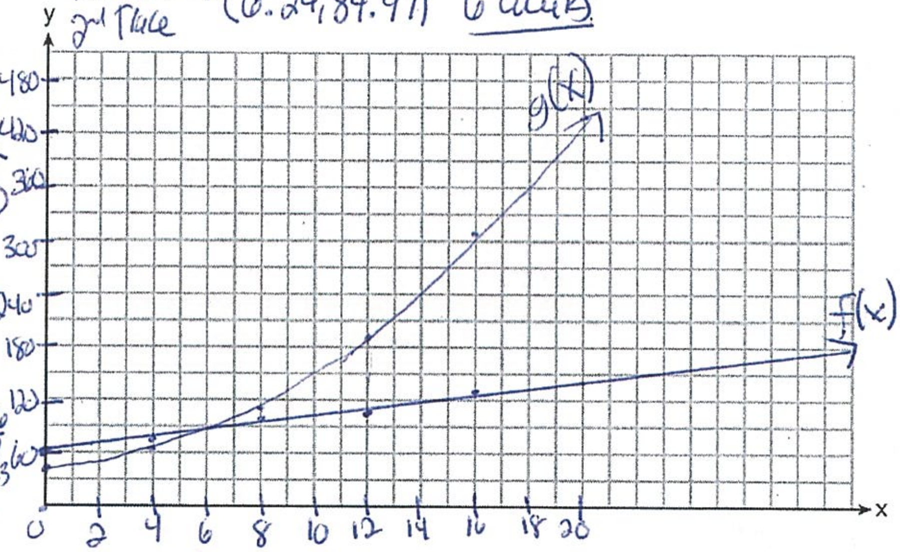
No domain: use Zoom fit — intersection 2nd Trace (6.24, 84.97) 6 weeks

x	y
0	60
4	76
8	92
12	108
16	124
20	140

x	y
0	46
4	62
8	110
12	190
16	302
20	446

Scale
$x \geq \frac{20}{30}$
$x \geq .6$
$x = 1$

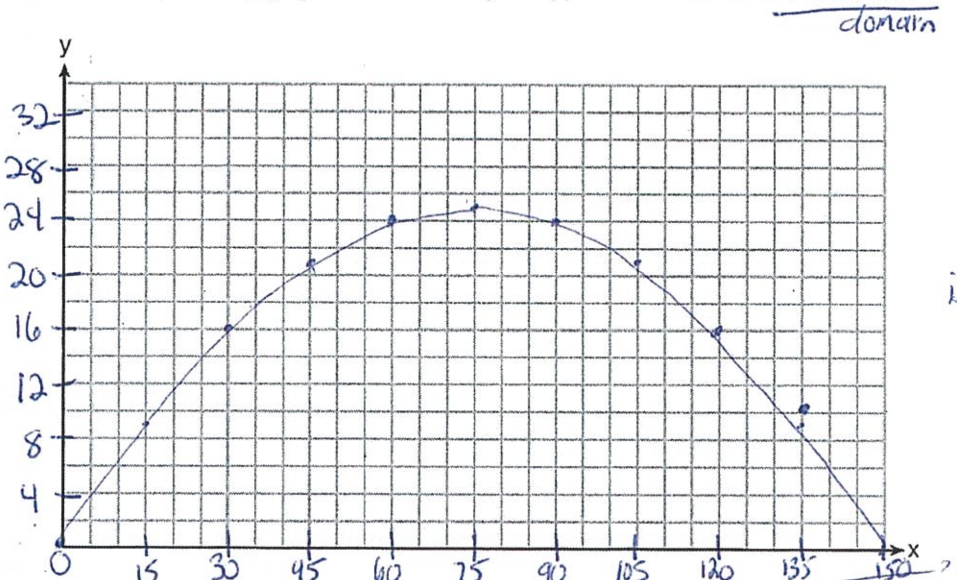
$y \geq \frac{446}{17}$
$y \geq 26.23$
$y = 30$



10. A football player attempts to kick a football over a goal post. The path of the football can be modeled by the function $h(x) = -\frac{1}{225}x^2 + \frac{2}{3}x$, where x is the horizontal distance from the kick, and $h(x)$ is the height of the football above the ground, when both are measured in feet. On the set of axes below, graph the function $y = h(x)$ over the interval $0 \leq x \leq 150$.

domain

x	y
0	0
15	9
30	16
45	21
60	24
75	25
90	24
105	21
120	16
135	9
150	0



No, (135, 9) is below (135, 10)

$45 \cdot 3 = 135$ ft
(135, 10)

Determine the vertex of $y = h(x)$. Interpret the meaning of this vertex in the context of the problem. The goal post is 10 feet high and 45 yards away from the kick. Will the ball be high enough to pass over the goal post? Justify your answer.

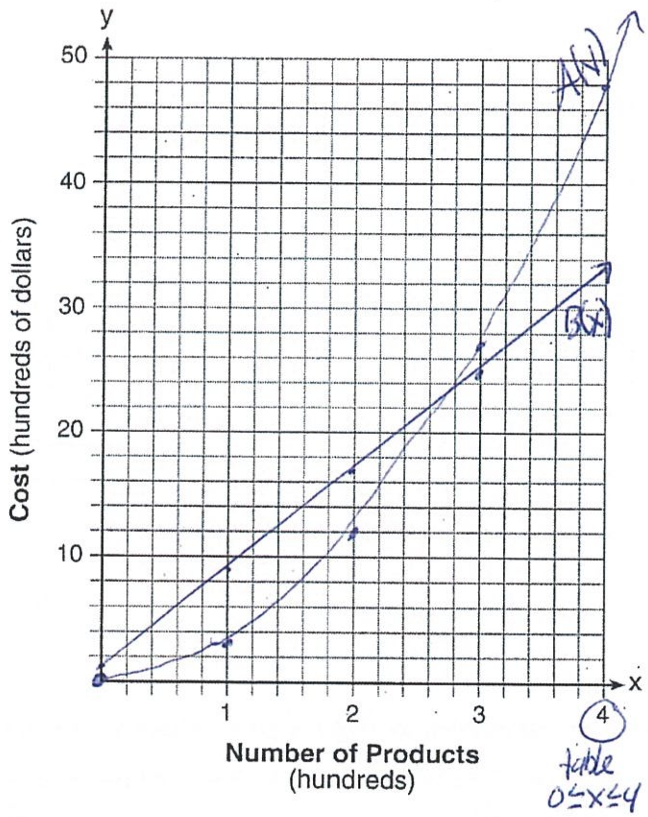
Scale:
$x \geq \frac{150}{30}$
≥ 5

$y \geq \frac{25}{17}$
$y \geq 1.47$
$y = 2$

(75, 25)
horizontal distance in ft — height in ft

The maximum height of the ball is 25 ft after a horizontal distance of 75 ft.

10. A company is considering building a manufacturing plant. They determine the weekly production cost at site A to be $A(x) = 3x^2$ while the production cost at site B is $B(x) = 8x + 1$, where x represents the number of products, *in hundreds*, and $A(x)$ and $B(x)$ are the production costs, *in hundreds of dollars*. Graph the production cost functions on the set of axes below and label them site A and site B.



A(x)

x	y
0	0
1	3
2	12
3	27
4	48

B(x)

x	y
0	1
1	9
2	17
3	25
4	33

State the positive value(s) of x, to the *nearest tenth*, for which the production costs at the two sites are equal. Explain how you determined your answer. If the company plans on manufacturing 200 products per week, which site should they use? Justify your answer.

2nd Trace, intersect → x=2

(2.79, 23.29)

2.8

I found the intersection using 2nd Trace menu.

A(2) = 12

B(2) = 17

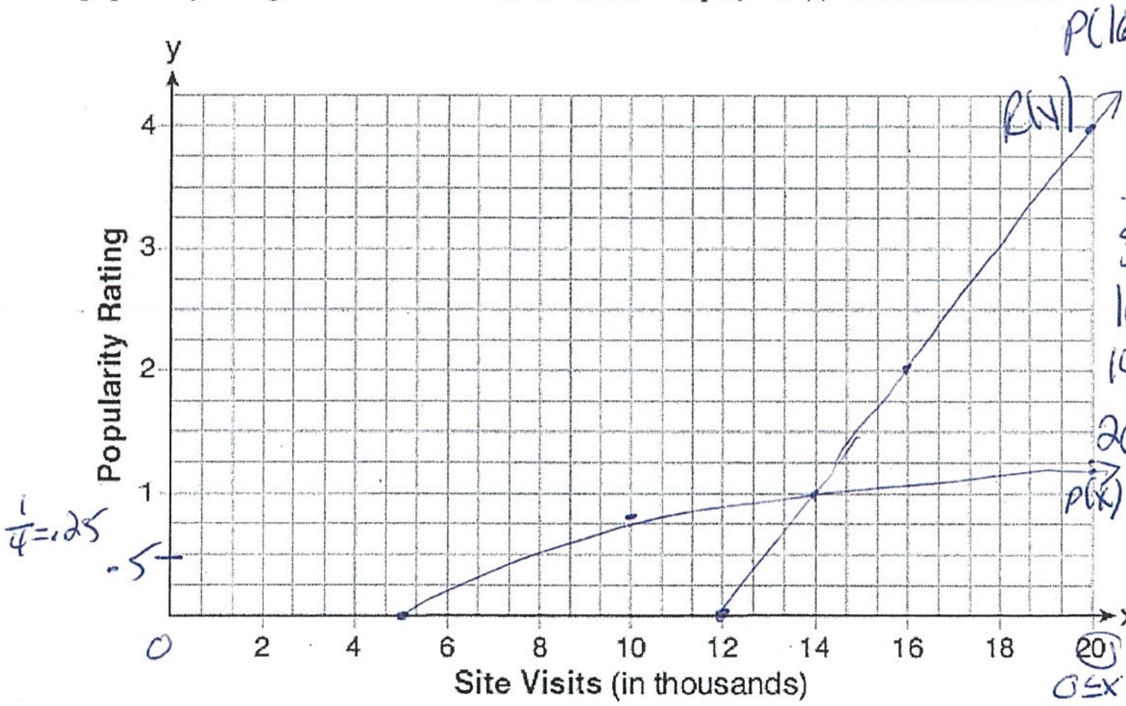
Site A will be less expensive

10. Website popularity ratings are often determined using models that incorporate the number of visits per week a website receives. One model for ranking websites is $P(x) = \log(x - 4)$, where x is the number of visits per week in thousands and $P(x)$ is the website's popularity rating. According to this model, if a website is visited 16,000 times in one week, what is its popularity rating, rounded to the *nearest tenth*? Graph $y = P(x)$ on the axes below.

$\rightarrow x = 16$

$P(16) = \log(16-4)$

$P(16) = 1.1$



x	y
5	0
10	.77815
14	1
20	1.2

$0 \le x \le 20$

An alternative rating model is represented by $R(x) = \frac{1}{2}x - 6$, where x is the number of visits per week in thousands. Graph $R(x)$ on the same set of axes. For what number of weekly visits will the two models provide the same rating?

Intersection

2nd Trace, Intersect

(14,1)

14000 weekly visits

x	y
0	-6
4	-4
8	-2
12	0
16	2
20	4

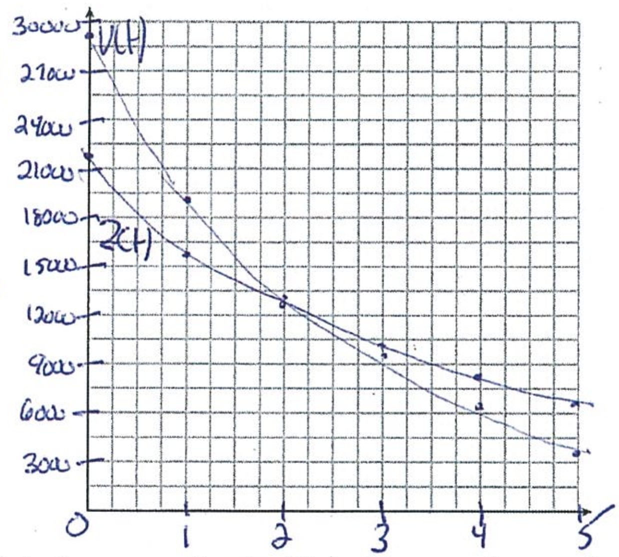
11. The value of a certain small passenger car based on its use in years is modeled by $V(t) = 28482.698(0.684)^t$, where $V(t)$ is the value in dollars and t is the time in years. Zach had to take out a loan to purchase the small passenger car. The function $Z(t) = 22151.327(0.778)^t$, where $Z(t)$ is measured in dollars, and t is the time in years, models the unpaid amount of Zach's loan over time. Graph $V(t)$ and $Z(t)$ over the interval $0 \le t \le 5$, on the set of axes below.

V(t)

X	y
0	28483
1	19482
2	13326
3	9114.8
4	6234.6
5	4264.4

Z(t).

X	y
0	22151
1	17234
2	13408
3	10431
4	8115.6
5	6313.4



Scale

$x \geq \frac{5}{20}$ $\quad y \geq \frac{28483}{20}$

$x \geq .25$ $\quad y \geq 1424.15$

$y = 1500$

State when $V(t) = Z(t)$, to the *nearest hundredth*, and interpret its meaning in the context of the problem. Zach takes out an insurance policy that requires him to pay a \$3000 deductible in case of a collision. Zach will cancel the collision policy when the value of his car equals his deductible. To the *nearest year*, how long will it take Zach to cancel this policy? Justify your answer.

3000

$t = 1.95$

After 1.95 years, the value of the loans will be the same (\$13569.24)

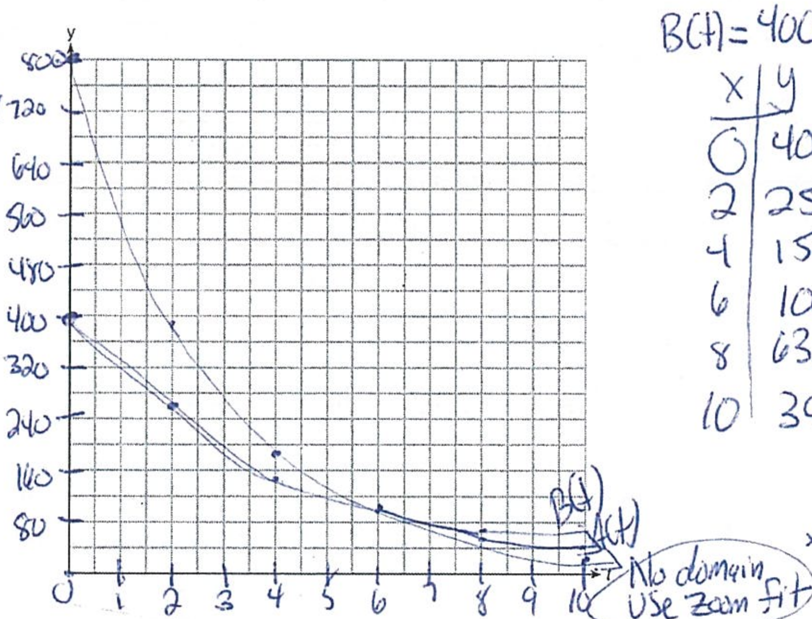
$Z(t) = 22151.327(0.778)^t$

$3000 = 22151.327(0.778)^t$

14. Drugs break down in the human body at different rates and therefore must be prescribed by doctors carefully to prevent complications, such as overdosing. The breakdown of a drug is represented by the function $N(t) = N_0(e)^{-rt}$, where $N(t)$ is the amount left in the body, N_0 is the initial dosage, r is the decay rate, and t is time in hours. Patient A, $A(t)$, is given 800 N_0 milligrams of a drug with a decay rate of 0.347. r Patient B, $B(t)$, is given 400 N_0 milligrams of another drug with a decay rate of 0.231. r Write two functions, $A(t)$ and $B(t)$, to represent the breakdown of the respective drug given to each patient. Graph each function on the set of axes below.

$A(t) = 800e^{-.347t}$

x	y
0	800
2	399.66
4	199.66
6	99.744
8	49.83
10	24.894



$B(t) = 400e^{-.231t}$

x	y
0	400
2	252.01
4	158.77
6	100.03
8	63.021
10	39.705

To the *nearest hour*, t, when does the amount of the given drug remaining in patient B begin to exceed the amount of the given drug remaining in patient A? The doctor will allow patient A to take another 800 milligram dose of the drug once only 15% of the original dose is left in the body. Determine, to the *nearest tenth of an hour*, how long patient A will have to wait to take another 800 milligram dose of the drug.

Same
2nd Trace
intersect

(5.98, 100.00)
6 hours

Scale

$x \geq \frac{10}{20}$ $\quad y \geq \frac{800}{20}$

$x \geq .5$ $\quad y \geq 40$

$x = .5$ $\quad y = 40$

$A(t) = .15(800)$

$.15(800) = 800e^{-.347t}$

Y_1 $\quad Y_2$ $\quad$ Find intersection

or

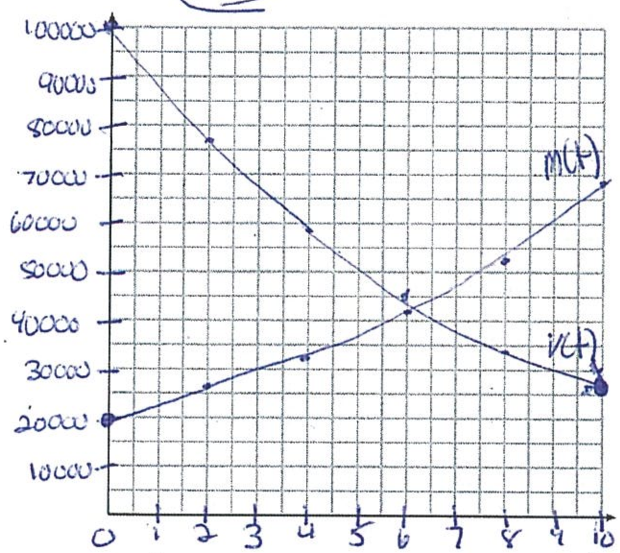
$\frac{.15(800)}{800} = \frac{800e^{-.347t}}{800}$

$\ln .15 = \ln e^{-.347t}$

$\frac{\ln .15}{-.347 \ln e} = \frac{-.347t \ln e}{-.347 \ln e}$

$5.5 = t$

16. The value of Tom's bank account is currently 100000 and is decreasing according to the equation $V(t) = 100000(.876)^t$. The amount of money he has paid for his mortgage can be represented by the equation $M(t) = 20000(1.1304)^t$. Graph and label $V(t)$ and $M(t)$ over the interval [0,10].



x	y
0	100000
2	76738
4	58887
6	45188
8	34676
10	26610

x	y
0	20000
2	25556
4	32656
6	41728
8	53320
10	68132

Scale

$x \geq \frac{10}{20}$ $\quad$ $y \geq \frac{100000}{20}$

$x \geq .5$ $\quad$ $y \geq 5000$

$x = .5$ $\quad$ $y = 5000$

After how many years will the value of Tom's bank account be equal to the amount of money he paid for his mortgage? Round your answer to the *nearest tenth of a year*. Tom will open a new bank account when the value of his account has decreased by 72%. After how many years, to the *nearest hundredth of a year*, will that happen?

$1 - .72$

$.28$

2nd Trace, Intersect

(6.3, 43356.8)

6.3 years

14. A major car company analyzes its revenue, $R(x)$, and costs $C(x)$, in millions of dollars over a fifteen-year period. The company represents its revenue and costs as a function of time, in years, x, using the given functions.

$$R(x) = 550x^3 - 12{,}000x^2 + 83{,}000x + 7000$$
$$C(x) = 880x^3 - 21{,}000x^2 + 150{,}000x - 160{,}000$$

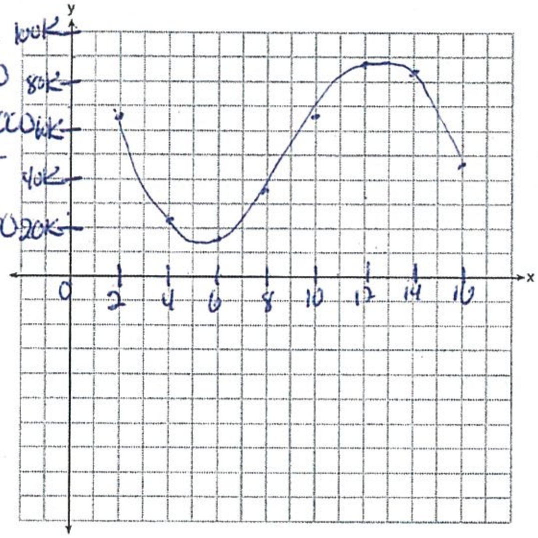
The company's profits can be represented as the difference between its revenue and costs. Write the profit function, $P(x)$, as a polynomial in standard form. Graph $y = P(x)$ on the set of axes below over the domain $2 \le x \le 16$.

$P(x) = R(x) - C(x)$

$P(x) = 550x^3 - 12000x^2 + 83{,}000x + 7000$

$+\ -880x^3 + 21000x^2 - 150{,}000x + 160000$

$P(x) = -330x^3 + 9000x^2 - 67000x + 167000$



X	y
2	66360
4	21880
6	17720
8	38040
10	67000
12	88760
14	87840
16	47320

Over the given domain, state when the company was the least profitable and the most profitable, to the *nearest year*. Explain how you determined your answer.

Least profitable is the relative minmum:

2nd Trace, minimum

(5, 15557)

5 years

Scale

$x \ge \frac{16}{18}$ $\quad y \ge \frac{88760}{10}$

$x \ge .\overline{8}$ $\quad y \ge 8876$

$x = 1$ $\quad y = 10000$

Most Profitable, is relative maximum

2nd Trace, Maximum

(13, 91996)

13 years