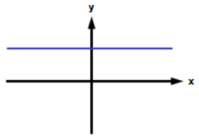
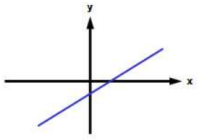
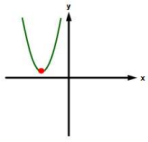
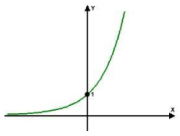
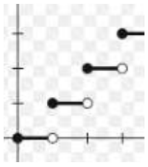
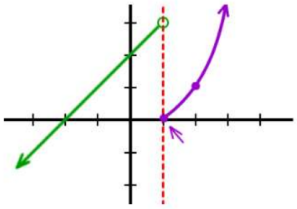
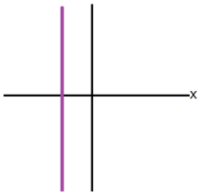
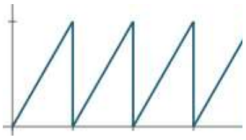
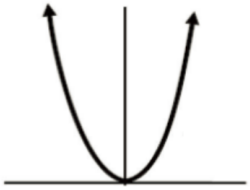




Chapter 4:
Types of Functions

Quadratic Function

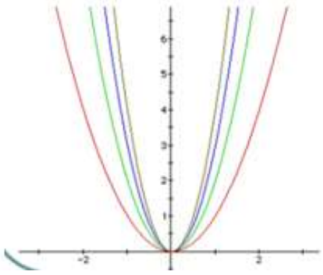


The equation is $y = ax^2$

This U-shape is called parabola and always passes through the origin. It is also symmetrical over the y axis.

The 'a' plays 2 roles:

1) **The bigger the value of 'a', the** skinnier **the parabola gets.**

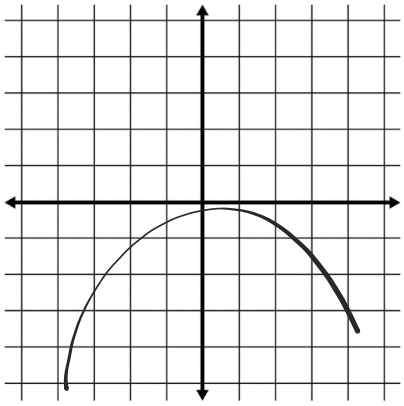


$y = x^2$
$y = 2x^2$
$y = 3x^2$
$y = 4x^2$

2) **If the 'a' is** negative **, then the parabola opens downwards.**

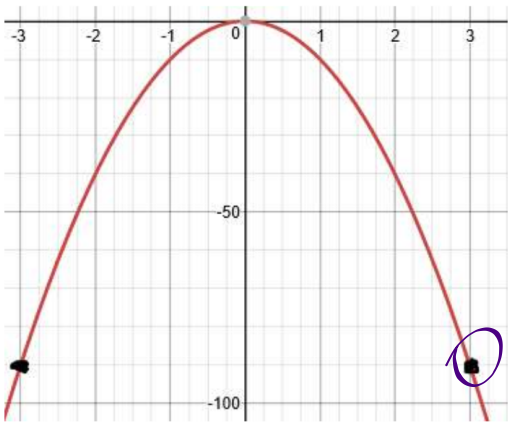
HOW TO GRAPH

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



x	y
-2	4
-1	1
0	0
1	1
2	4

Quadratic function
Finding the rule from a graph



$y = ax^2$

plug in a coordinate (3, -90)
x = 3 and y = -90
$-90 = a(3)^2$
$-90 = 9a$
$a = -10$

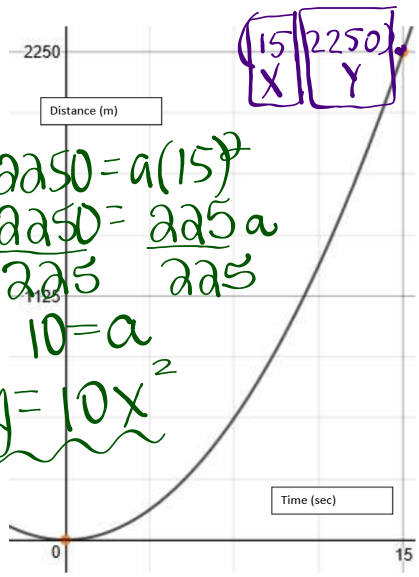
Answer: $y = -10x^2$

Word Problems:

Below is the graph of a rocket before launching.

a. Define the variables and find the rule.

x: Time (sec)
y: Distance (m)
$y = ax^2$



$2250 = a(15)^2$
$\frac{2250}{225} = \frac{225a}{225}$
$10 = a$
$y = 10x^2$

Functions Booklet page 1-9

›. At what distance is the pilot after 20 seconds? $y=10x^2$

$=10(20)^2$

$=10(400)=4000m$

:. How much time after ejection is the pilot 9000m away from initial point of ejection?

$y=10x^2$

$\frac{9000}{10}=\frac{10x^2}{10}$

$\sqrt{900}=\sqrt{x^2}$

$x=30sec$

He was 30 sec away

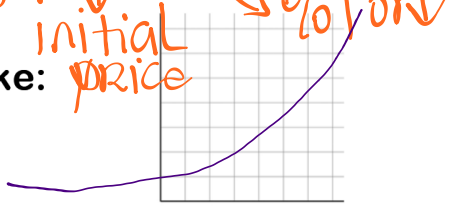
EXPONENTIAL FUNCTION

Real Life Situations:

→ technology → real estate
→ gold → clothes/shoes

The equation is: $y = a \cdot (c)^x$ (a: initial price; c: % up or down)

The graph looks like:



Note: The exponential function is the shape of a curve **and not a** line.

HOW TO FIND THE BASE 'C'

↑ **30%** $\frac{30}{100} = 0.30$ ↓ **30%** $\frac{30}{100} = 0.30$

DO $1 + 0.30$ $= 1.30$ **DO** $1 - 0.30$ $= 0.70$

Doubles means c = 2
Triples means c = 3
Quadruples means c = 4

EXPONENTIAL FUNCTION

Finding the equation

$y = ac^x$

1) 11%, IV= 20 000$

$11/100 = 0.11$ $1 + 0.11 = 1.11$ $y = 20000(1.11)^x$

2) 5%, IV = 5 000 lizards

$5/100 = 0.05$ $1 - 0.05 = 0.95$ $y = 5000(0.95)^x$

3) 7%, IV = 1 inhabitant

$7/100 = 0.07$ $1 + 0.07 = 1.07$ $y = 1(1.07)^x$

4) 4%, IV = 50 bacteria

$4/100 = 0.04$ $1 - 0.04 = 0.96$ $y = 50(0.96)^x$

Solve for x

If $y = 74.6$, solve for x in the equation

$y = 30(1.2)^x$.

Trial & Error

$\frac{74.6}{30} = \frac{30(1.2)^x}{30}$

$2.49 = 1.2^x$

$x = 5$

x^y

y^x

If $y = 13$, Solve for x in the equation

$y = 100(0.6)^x$.

$\frac{13}{100} = \frac{100(0.6)^x}{100}$

$0.13 = 0.6^x$ $\rightarrow x = 4$

Word Problems

1. Your hands contain 2000 bacteria. The value doubles per hour. How much bacteria will there be after 5 hours?

$y = 2000(2)^x$

x: # of hr

y: # of Bacteri

$y = 2000(2)^5$

64000 Bacteria

x^y or y^x or $\wedge$

2. In 1990, a house valued 200 000$ and increased by 7% yearly. How much will it be worth in 1996?

$y = ac^x$

$y = 200000(1.07)^x$

$y = 200000(1.07)^6$

3. An antique car costs 30 000$ and increases in value by 10% per year. How much was the car worth 3 years ago?

x: # of years

y: Value of Car

$y = 30000(1.1)^{x}$

$y = 30000(1.1)^{-3}$

≈ 22 539.44$

5) 1.15 ↑15% 0.80 ↓20%

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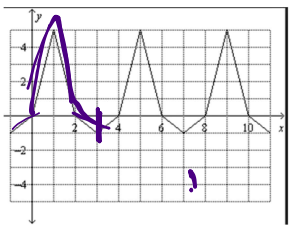
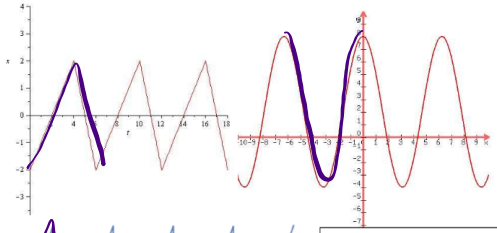
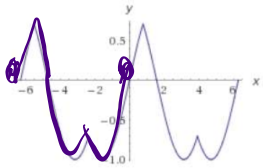
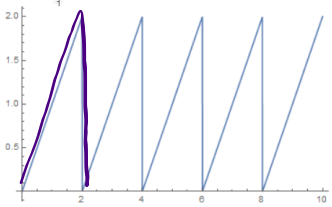
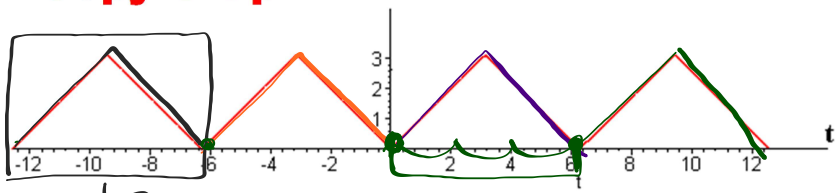
Periodic function

A periodic function is a function which always repeats itself.

DO NOT COPY GRAPHS

Copy Graph



cycle

Three terms:

Cycle: it is 1 repetition

Period: how many units it takes for 1 cycle $P = 6$

Frequency: $= \frac{1}{\text{PERIOD}}$ $F = \frac{1}{6}$

$f(x)=$

$f(0)=$ if x is 0, what is y? $=2$

$f(2)=2$

$f(5)=0$

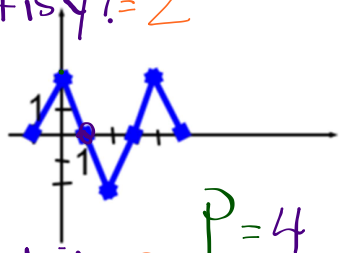
$f(22)=f(2)=-2$

$f(-11)=f(1)=$ Read it 0

$f(17)=f(5)=0$

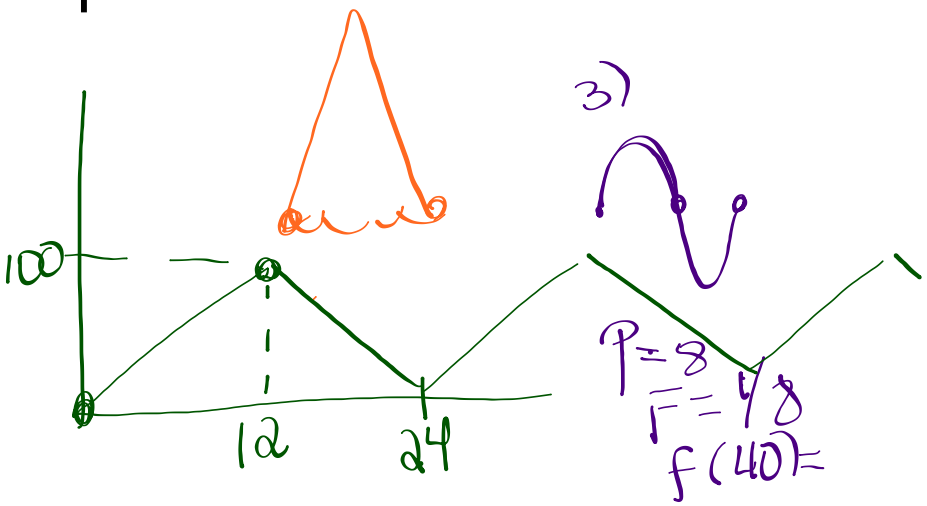
$f(-15)=f(1)=0$

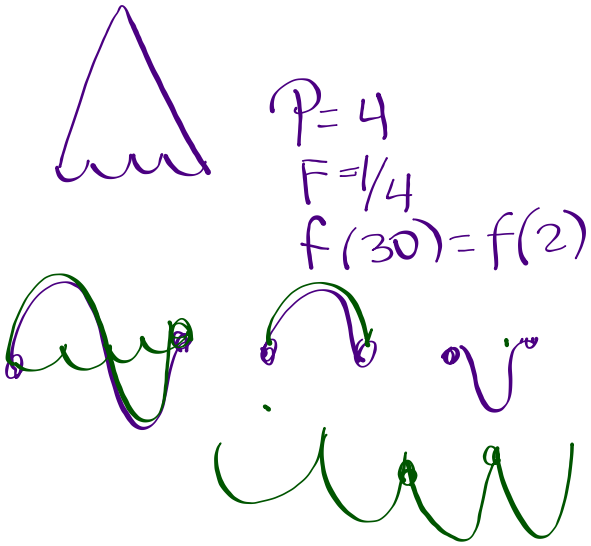
$-11+4+4+\cdots$



$P=4$

rip out 17-18-19 on cart





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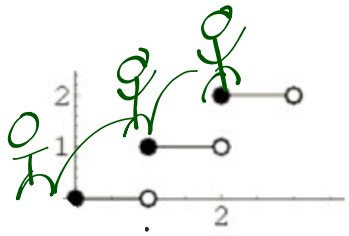
Functions Booklet page 15-27

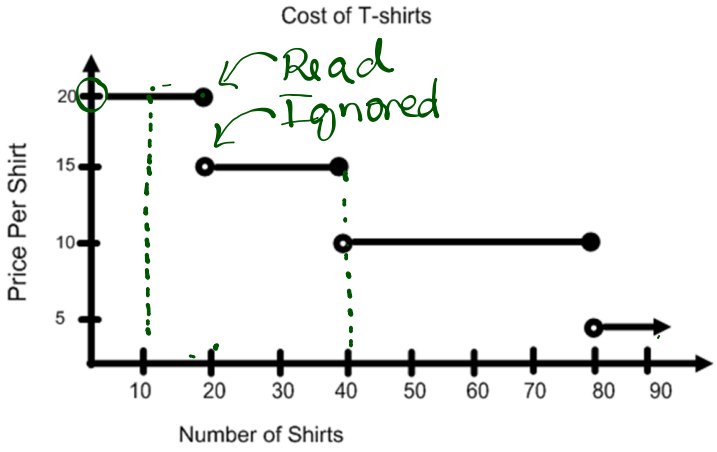
Step Function



A function that increases or decreases abruptly from one constant value to another.

● closed DOT include value ○ open dot exclude value

Find $f(0)$ meaning when $x = 0, y =$ 0
Find $f(10) =$ 20
Find $f(40) =$ 15$
Find $f(120) =$ 5$

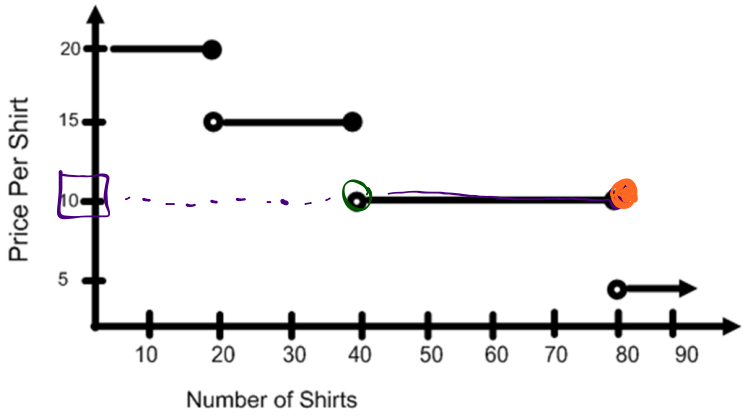


Find the values of x for which

$a)\ f(x) = 10$ $]40, 80]$

$b)\ f(x) = 5$ $]80, \infty[$

$c)\ f(x) = 15$ $]20, 40]$



The function has no equation

The graph contains horizontal segments closed **on one end and** open **on the other.**

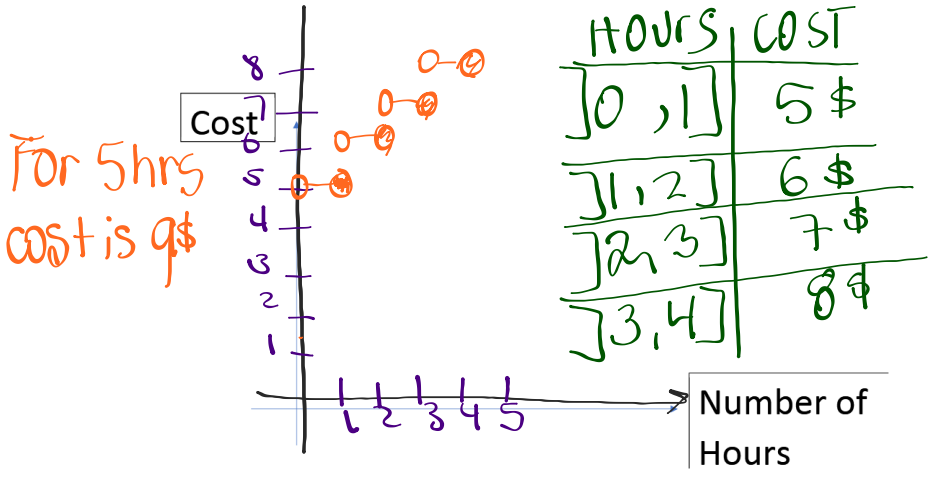
Word Problems:

Talking about parking lots… Did you know about the BMW Welt in Germany?

Youtube:

Discover the BMW Welt - BMW Group
https://youtu.be/FjM94ZpWib4

Ex: A parking lot charges 5$ the first hour or part thereof plus 1$ every additional hour or part thereof. Make a table of values and then graph. Find the cost of parking for 5 hours.



Word Problems

1. A salesman receives a weekly base salary of 200$ plus a bonus of 30$ for every 500$ in sales made during the week.

a) Make a table of values and graph.

go by Sales

Sales$	Salary$
[0,500[	200
[500,1000[	230$
[1000,1500[	260$

go up by Bonus

b) What will his salary be if he makes 946$ in sales in one week? (use tov) 230$

c) In which interval lies the amount of sales made in a week where the salesman receives a salary of 290$? (use tov)

[1500,2000[

2. Canada Post charges 4$ for a mass less than or equal to 40g and 1.50$ for each additional 40g.

a. Make a table of values and graph.

Mass g	Cost
]0,40]	4$
]40,80]	5.50$
]80,120]	7.00$

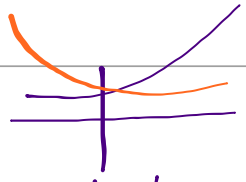
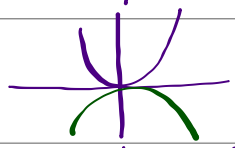
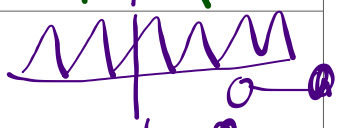
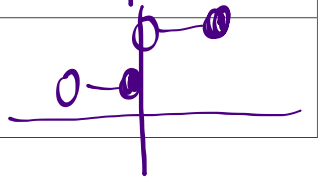
b. What is the cost of sending a 168g parcel? (use tov) 10$

c. In what interval lies the mass of a parcel if it costs 10$? (use tov)

]160,200]

Functions Booklet page 28-55

Review of Functions

	Equation	Graph
Exponential	$y = a \cdot c^x$	
Quadratic	$y = a x^2$	
Periodic	No Rule	
Step	No Rule	

Functions Booklet

pages 1-55

Piecewise Function

≥ greater or =

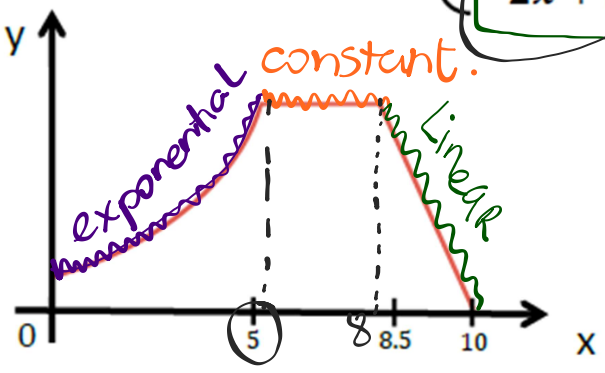
≤ less than or =

$$f(x) = \begin{cases} 2(1.20)^x & ; 0 \le x \le 5 \\ 5 & ; 5 \le x \le 8 \\ -2x + 21 & ; 8 \le x \le 10.5 \end{cases}$$

between

between

between



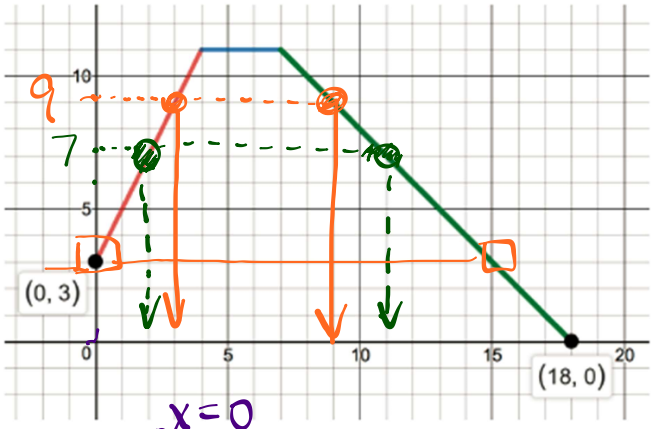
Find $f(8.5)$

When $x = 8.5$ what is y.

$y = -2(8.5) + 21$

$y = 4$

How to read the graph:



Find $f(0)$ = 3

Find $f(5)$ = 11

Find $f(10)$ = 8

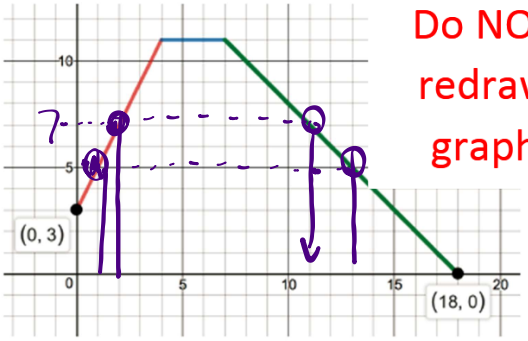
Find x when $f(x) = 7$ {2, 11}

Find x when $f(x) = 9$ {3, 9}

Find x when $f(x) = 3$ {0, 15}

How to read the equation:

$$f(x) = \begin{cases} 2x + 3, & 0 \le x \le 4 \\ 11, & 4 \le x \le 7 \\ -x + 18, & 7 \le x \le 18 \end{cases}$$



Do NOT redraw graph

Use the equation

Find the y value

$f(10)$ = 8

$f(3.5)$ = 10

$f(5)$ = 11

Find the x value

If $f(x) = 5$ find x {1, 13}

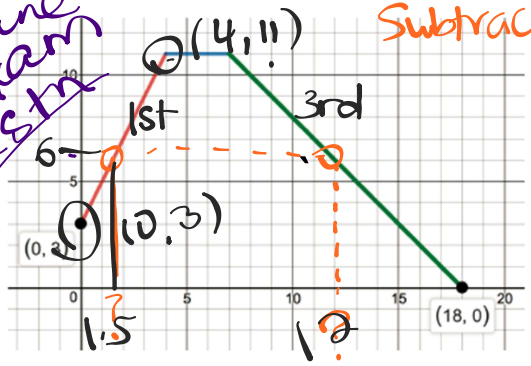
If $f(x) = 7$ find x {2, 11}

If $f(x) = 6$, find the differences in the x values.

Y

June Exam Qstn

Subtract



$$f(x) = \begin{cases} 2x + 3, & 0 \le x \le 4 \\ 11, & 4 \le x \le 7 \\ -x + 18, & 7 \le x \le 18 \end{cases}$$

Do NOT redraw graph/equations

$Y = 2x + 3$

$6 = 2x + 3$

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

$x = 1.5$

$12 - 1.5 = 10.5$

$Y = -x + 18$

$6 = -x + 18$

$\frac{-12}{-1} = \frac{-x}{-1}$

$x = 12$

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