# Pre-Calculus Math 12



## Materials:

- McGraw-Hill Ryerson Pre-Calculus 12 Textbook (~$100)
- Graphing Calculator Required (TI-83 plus or TI-84 or TI-84 plus)
- Graphing Paper, pencils, erasers

## Structure:

This course is generally designed with the self-paced student in mind. There will be a chapter outline showing a brief explanation of the material with some examples and solutions as well as links to YouTube lessons by various teachers. This material will follow the new curriculum as per the BC Ministry of Education Learning Outcomes and will include some Aboriginal Content.

## Outline:

| | |
|---|---|
| Chapter 1 | Function Transformations |
| Chapter 3 | Polynomial Functions |
| Chapter 4 | Trigonometry & the Unit Circle |
| Chapter 5 | Trigonometry Functions & Graphs |
| Chapter 6 | Trigonometric Identities |
| Chapter 7 | Exponential Functions |
| Chapter 8 | Logarithmic Functions |
| Chapter 9 | Rational Functions |
| ---- | Geometric Sequences & Series |

## Evaluation:

There are 9 chapter tests which account for 30% of the final mark. There are 4 cumulative tests which account for 70% of the final mark.

## Composition:

The course is made up of:

- 9 Chapter Outlines
- 9 Chapter Tests each with an A and a B version (18 tests), Plus (18 tests) Answer Keys
- 4 Cumulative Unit Tests with an A and a B version (8 tests), Plus (8 tests) Answer Keys
- All Answer Keys have a suggested marking scheme
- All files are put on disk in pdf and MS Word
- A perpetual license for your school
- The entire paper course is placed in a binder along with the disk and shipped as one unit.

**Cost: $ 495.00.** ***See Ordering on website.***

# Pre-Calculus Math 12 Record Chart

**Name:** **Commencement Date:**

| Chapter | Topic | % on Test A | % on Test B | % on Cumulative Unit Test | Date |
|---|---|---|---|---|---|
| 1 | Function Transformations | | | | |
| 3 | Polynomial Functions | | | | |
| Unit 1 Transformations & Functions Cumulative Test | | | | | |
| 4 | Trigonometry & the Unit Circle | | | | |
| 5 | Trigonometry Functions & Graphs | | | | |
| 6 | Trigonometric Identities | | | | |
| Unit 2 Trigonometry Cumulative Test | | | | | |
| 7 | Exponential Functions | | | | |
| 8 | Logarithmic Functions | | | | |
| Unit 3 Exponential & Logarithmic Functions Cumulative Test | | | | | |
| 9 | Rational Functions | | | | |
| - | Geometric Sequences & Series | | | | |
| Unit 4 Rational Functions & Geometric Sequences & Series Cumulative Test | | | | | |

## Course Evaluation

| Course Evaluation | Total Percent | Out of Percent | Calculated Percent | Value | Result |
|---|---|---|---|---|---|
| Chapter Tests (9) | | 900 | | 30% | |
| Cumulative Unit Tests (4) | | 400 | | 70% | |
| | | | | Final Mark | |

# Unit 1: Transformations and Functions

Textbook: Pre-Calculus 12 by McGraw-Hill Ryerson

## Chapter 1: Function Transformations

**Learning Outcomes:**

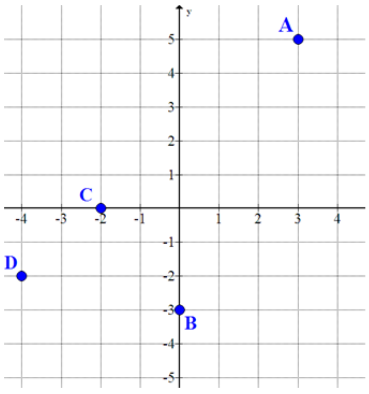
- Graphing & identifying functions
- Graphing & identifying horizontal and vertical translations & stretches
- Graphing & identifying reflections and inverse functions
- Graphing & identifying combined transformations of functions
- Algebraically determining the equation of the inverse of a function

### Graphing Review

**View these YouTube videos:**

http://tinyurl.com/pc12basic-graphs
http://tinyurl.com/pc12domain-range

We graph ordered pairs on a coordinate system. The first coordinate is the *x*-coordinate, and indicates how far to move left or right from the origin, (0, 0). The second coordinate is the *y*-coordinate, and tells how far to move up or down.

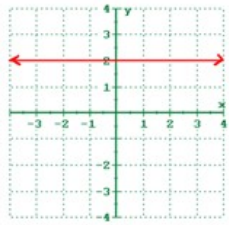



The coordinates of the points on the grid:
A = (3, 5)
B = (0, -3)
C = (-2, 0)
D = (-4, -2)

Given an equation relating the variables *x* and y, we can sketch its graph by making a table of values by hand or by using a graphing calculator. Either way, we usually isolate *"y"* first.

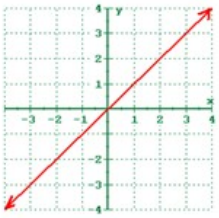
**Common Functions:**

**Constant Function**



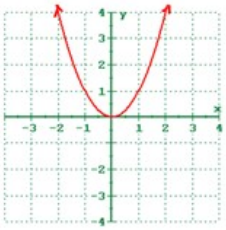
$y = C$

**Linear Function**



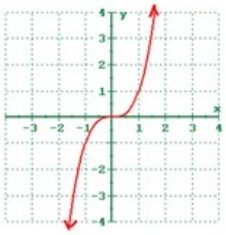
$y = mx + b$

**Quadratic Function**



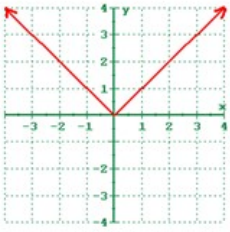
$y = Ax^2 + Bx + C$

**Cubic Function**



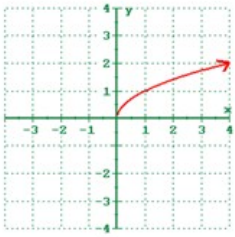
$y = x^3$

**Absolute Value Function**



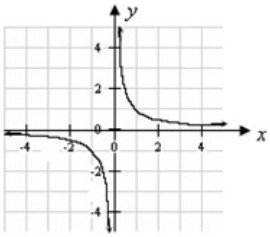
$y = |x|$

**Square Root Function**



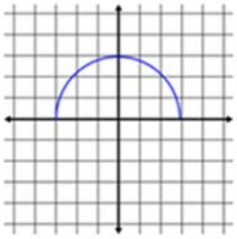
$y = \sqrt{x}$

**Reciprocal Function**



$y = \frac{1}{x}$

**Semi-circle Function**



$y = \sqrt{C - x^2}$

**Domain** is the set of all $x$ values that are valid for a function.
**Range** is the set of all $y$ values that are valid for a function.

**Example**: consider the quadratic function $y = x^2$ which is graphed above. The domain is: $x$ is all real numbers and the range is: $y$ is greater than and equal to zero. This is written as:

$$Domain: \{x \mid x \in R\}$$
$$Range: \{y \mid y \geq 0, y \in R\}$$

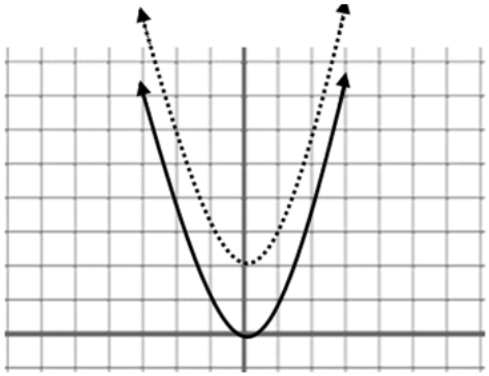
# Section 1.1: Horizontal and Vertical Translations

Study the notes and examples on pages 8-11 and memorize the **Key Ideas** on page 12.
View these YouTube videos for lessons on this section:
http://tinyurl.com/PC12Sec1-1
http://tinyurl.com/PC12Sec1-1-B

**Vertical translations** transform the graph of $y = f(x)$ to $y - k = f(x)$ or $y = f(x) + k$ and result in the graph and its points moving up or down by $k$ units.

- **When $y$ is replaced with $y - k$ translate $k$ units up -** $(x, y) \to (x, y + k)$.
- **When $y$ is replaced with $y + k$ translate $k$ units down -** $(x, y) \to (x, y - k)$.

**Example**: if $y = x^2$ is compared to $y - 2 = x^2$, the parabola is translated 2 units up. Note: you can also rewrite this as $y = x^2 + 2$. Each *y*-coordinate on the graph is moved 2 units up by adding 2. This means the point (0,0) on $y = x^2$ is now the image point (0,2) on $y - 2 = x^2$. Using mapping notation, we write these points in general as $(x, y) \to (x, y + 2)$



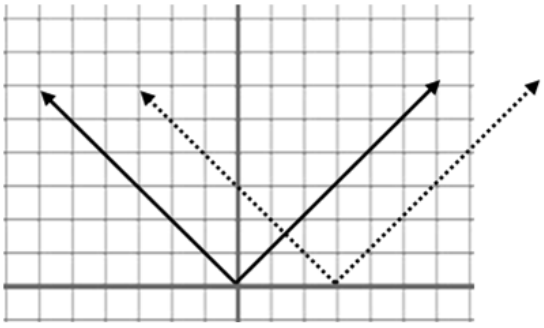
$Domain: \{x \mid x \in R\} \to \{x \mid x \in R\}$

$Range: \{y \mid y \geq 0, y \in R\} \to \{y \mid y \geq 2, y \in R\}$

**Horizontal translations** transform the graph of $y = f(x)$ to $y = f(x - h)$ and result in the graph and its points moving right or left by *h* units.

- **When *x* is replaced with $x - h$ translate *h* units right -** $(x, y) \to (x + h, y)$.
- **When *x* is replaced with $x + h$ translate *h* units left -** $(x, y) \to (x - h, y)$.

**Example**: if $y = |x|$ is compared to $y = |x - 3|$, the absolute value graph is translated 3 units to the right. Each *x*-coordinate on the graph is moved 3 units right by adding 3. This means the point (0,0) on $y = |x|$ is now the image point (3,0) on $y = |x - 3|$. Using mapping notation, we write these points in general as $(x, y) \to (x + 3, y)$



$Domain: \{x \mid x \in R\} \to \{x \mid x \in R\}$

$Range: \{y \mid y \geq 0, y \in R\} \to \{y \mid y \geq 0, y \in R\}$

Complete the following questions and check your answers with the solutions at the back of the text.

| Section | Page | Practice Questions | Check When Done |
|---|---|---|---|
| 1.1 | 12-14 | 1, 2, 3cd, 4ac, 5, 8, 10, 11 | ☐ |

# Unit 1: Transformations and Functions

Textbook: Pre-Calculus 12 by McGraw-Hill Ryerson

## Chapter 3: Polynomial Functions

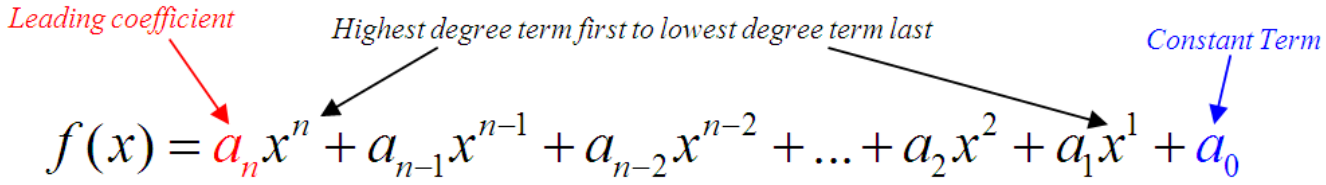
**Learning Outcomes:**

- Identifying and examining characteristics of polynomial graphs
- Dividing polynomials using the Remainder Theorem & using the Factor Theorem
- Graphing polynomials with and without Graphing Technology

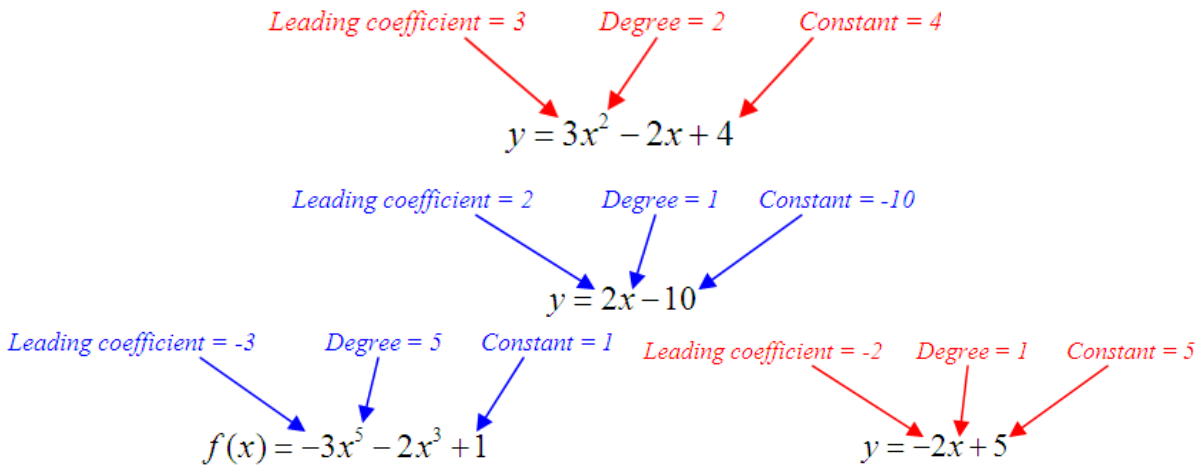
## Section 3.1: Characteristics of Polynomial Functions

Study the notes and examples on pages 106-112 and memorize the **Characteristics** on page 109 and the **Key Ideas** on page 113.
View the YouTube video:
http://tinyurl.com/pc12sec3-1

**Polynomial functions** are functions with many terms, where the variable (usually $x$) has different exponents for each term ($n$ called the degree) and there is usually a constant without the variable included at the end of the polynomial. It is written with the highest degree (highest exponent) term first and the other terms in descending order to the constant term, $a_0$, last. Coefficients are the integers in front of the variable for each term.




Examples of Polynomials:




Not polynomials:

$f(x) = \sqrt{x} + 2x - 4$ can also be written as $f(x) = x^{\frac{1}{2}} + 2x - 4$: here the degree is a fraction and not an integer; therefore not a polynomial

$y = |2x| - 3$: this is an absolute value function and not a polynomial

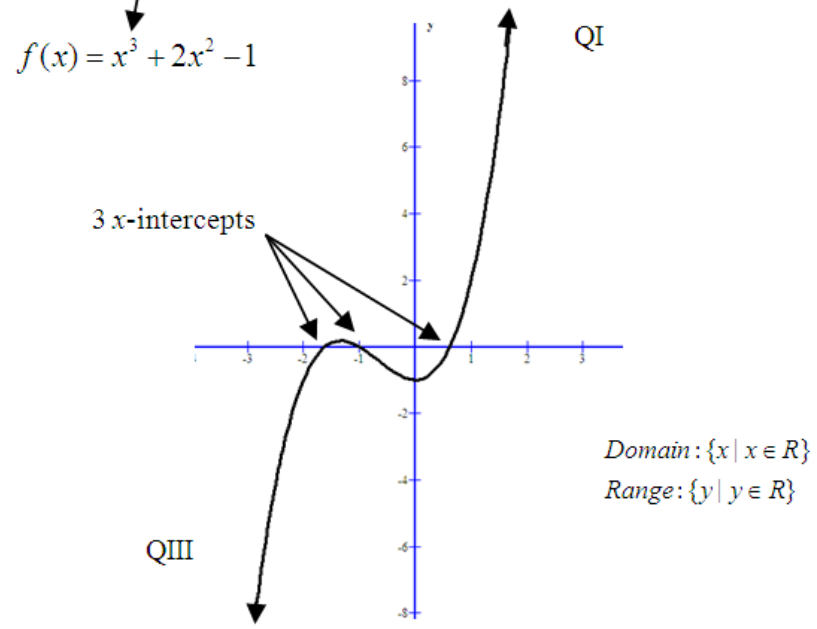
$f(x) = \dfrac{2}{x^2 - 2x - 3}$; this is a rational function and not a polynomial

**Characteristics of polynomial functions** include identifying the highest degree of the function which tells you the direction that the graph flows in the quadrants and the number of *x*-intercepts.

- **If the polynomial had an odd degree and positive leading coefficient, the graph goes from quadrant III to quadrant I and has 1 to *n* *x*-intercepts.**
- **If the polynomial had an odd degree and negative leading coefficient, the graph goes from quadrant II to quadrant IV and has 1 to *n* *x*-intercepts.**

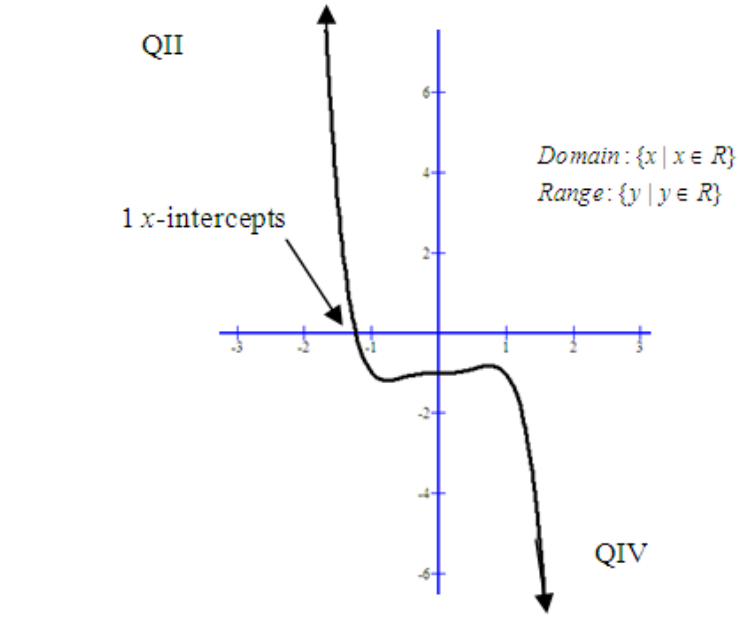
*Odd degree and positive leading coefficient*

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



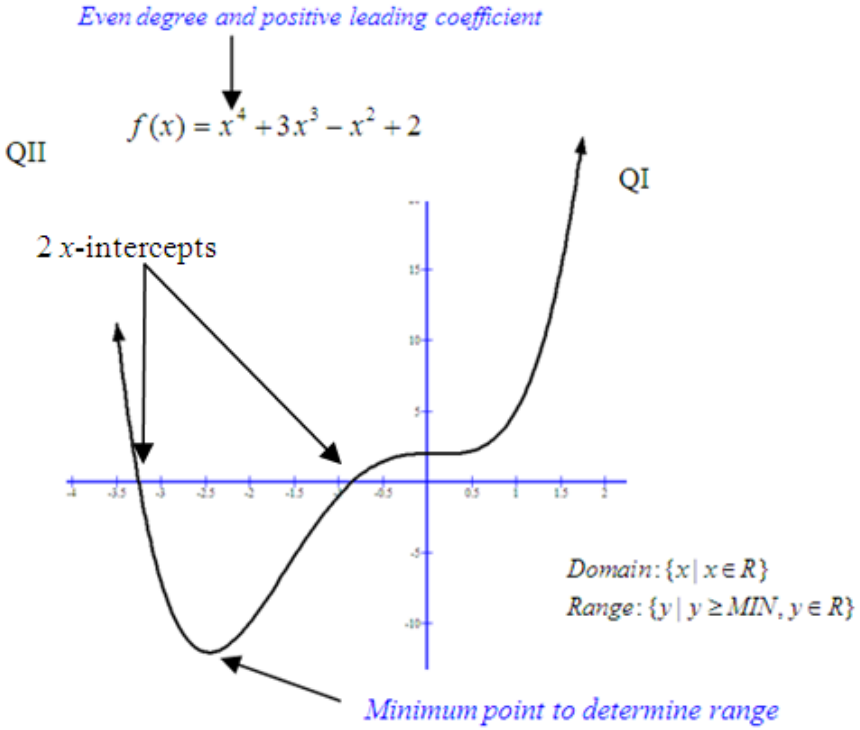

*Odd degree and negative leading coefficient*

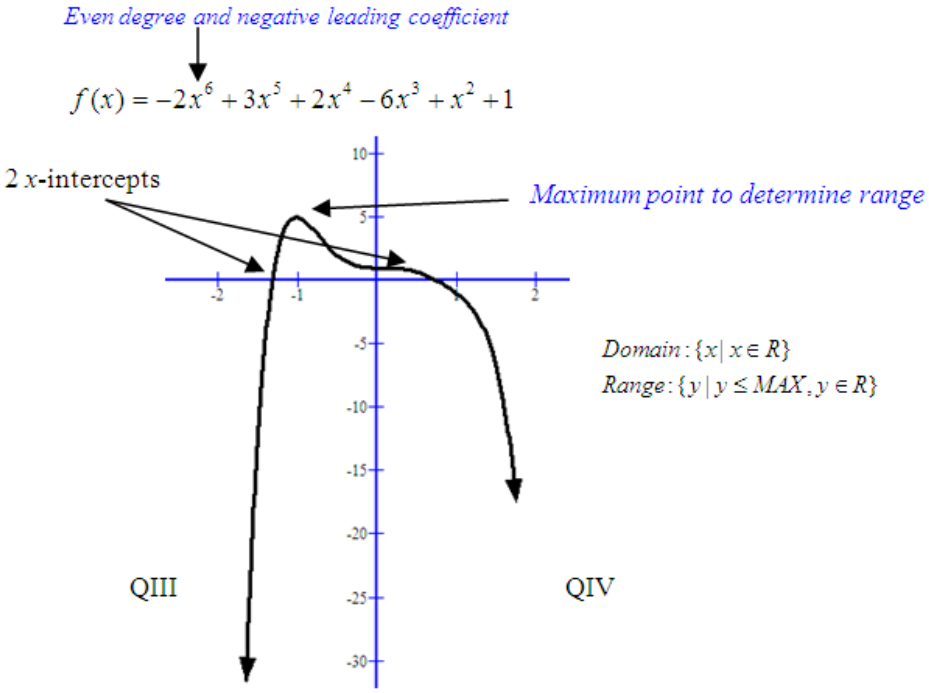
$f(x) = -x^5 + x^3 - 1$




- **If the polynomial had an even degree and positive leading coefficient, the graph goes from quadrant II to quadrant I and has 0 to *n* *x*-intercepts.**

- **If the polynomial had an even degree and negative leading coefficient, the graph goes from quadrant III to quadrant IV and has 0 to *n* *x*-intercepts.**




Complete the following questions and check your answers with the solutions at the back of the text.

| Section | Page | Practice Questions | Check When Done |
|---|---|---|---|
| 3.1 | 114-116 | 1, 2acef, 3, 4ace, 6, 7, 9 | ☐ |

# Pre-Calculus 12: Chapter 1 - Function Transformations Test A

**Name: _____ Date:_____**

_____

**30**

Marks

(2) 1. Describe the transformations in the following equations:

a) $y = (x-1)^2 + 2$

b) $y = \frac{1}{x+2} - 1$

(2) 2. If the point (2, -1) is on the graph of $y = f(x)$, what is the point on the graph of $y = f(x-2)-3$?

(1) 3. Write the function $y = \sqrt{x}$, with the following translations:

2 units right and 5 units up

(1) 4. If the point (m, n) is on the graph of $y = f(x)$, which of the following is the point on the graph of $y = f(x+1)-3$?

a) (m+1, n+3)

b) (m+1, n-3)

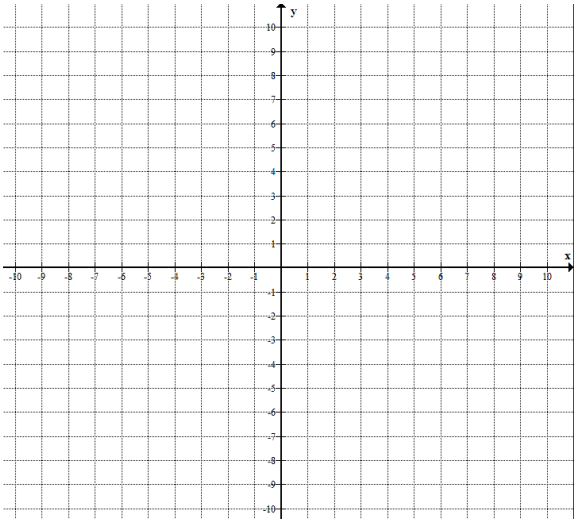
c) (m-1, n-3)

d) (m-1, n+3)

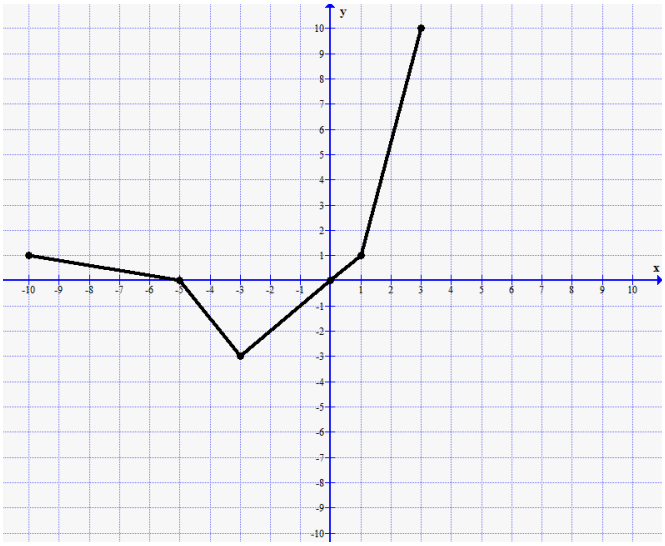
(5) 11. Graph the following function and determine the domain and range of the function.

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

Domain = Range =




(2) 12. Given the graph of $y = f(x)$, graph the inverse of the function on the same grid.



## Pre-Calculus 12: Chapter 1 - Function Transformations Test A

**Name:** KEY **Date:**_____

_____

**30**

Marks

(2) 1. Describe the transformations in the following equations:

a) $y=(x-1)^2+2$ b) $y=\frac{1}{x+2}-1$

horizontally translated 1 unit right vertically translated 2 units up

2 left 1 down

(2) 2. If the point (2, -1) is on the graph of $y=f(x)$, what is the point on the graph of $y=f(x-2)-3$?

2 right 3 down

2+2 -1-3

(4, -4)

(1) 3. Write the function $y=\sqrt{x}$, with the following translations:

2 units right and 5 units up

$y=\sqrt{x-2}+5$

(1) 4. If the point (m, n) is on the graph of $y=f(x)$, which of the following is the point on the graph of $y=f(x+1)-3$?

a) (m+1, n+3)
b) (m+1, n-3)
C c) (m-1, n-3)
d) (m-1, n+3)

1 left, 3 down

m-1 n-3

(5) 11. Graph the following function and determine the domain and range of the function.

$y-2=\frac{1}{2}|-x+1|$ ← absolute value function with vert. compression of $\frac{1}{2}$ + 2 up, reflection over y-axis + 1 right

$y=\frac{1}{2}|-(x-1)|+2$

Domain = $\{x|x\in\mathbb{R}\}$ Range = $\{y|y\geq 2, y\in\mathbb{R}\}$