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Math 120 Precalculus Review

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Mathematics and Computer Science Department

Open Pedagogy Project

Precalculus Review

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Precalculus Review

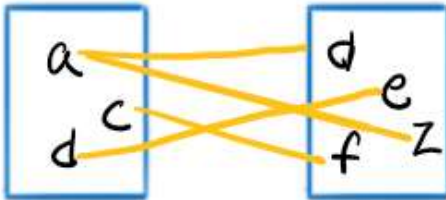
This Precalculus Review is a result of the Open Pedagogy project implemented at York College which invites students to contribute to open educational resources, and not just being a consumer of it. Specifically, students created mathematics questions that corresponded to the topics learned in the course. Forthcoming students will have the chance not only to create more questions for the file, but to update and/or revise the document. Future students will also engage in creating an answer key (with worked out solutions) for the file, as well as video help. These practice questions should be helpful for any precalculus course.

Email ythompson@york.cuny.edu with comments, corrections, or suggestions for this document. York students can visit the [Math Learning Center](#) on campus (if permitted) at (MLC - 3E07C) or virtually with regards to getting tutoring services for the precalculus course work.

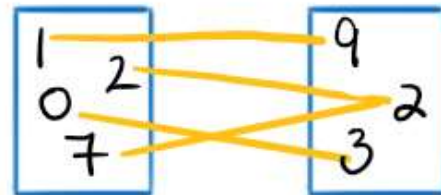
Objective One: Functions

1) Determine if the following relationship represents a function type relationship or not.

a)



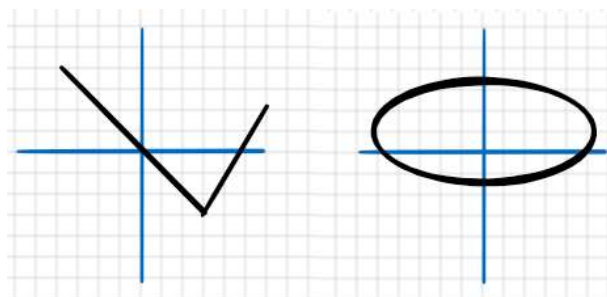
Yes / No



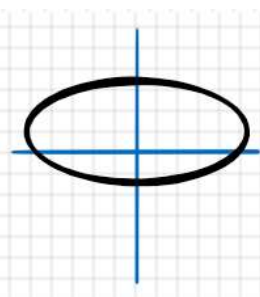
Yes / No

b) $(-2,3)$ $(6,3)$ $(5,2)$ $(1,4)$ $(8, 1)$ Yes / No

c)



Yes / No



Yes / No

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2) Find the inverse of the function for $f(x) = -4x + 1$.

3) What makes a function a 1-1?

4) Given the functions $f(x) = 5x^2 - 4x$, $g(x) = 2x - 6$ and $h(x) = \frac{1}{x+4}$, answer the following question:

a) Evaluate: $f(2)$, $g(-3)$ and $h(0)$

b) Find: $(f + g)(x)$

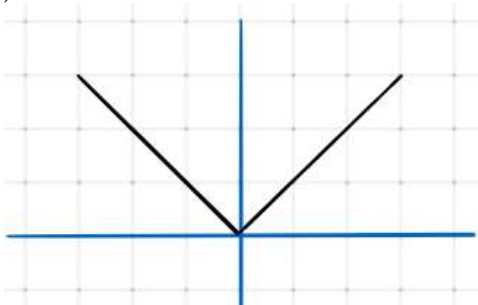
c) Find: $(fg)(1)$

d) $(g \circ h)(x)$

5) Determine if the following functions are Odd, Even or neither. You MUST justify your answers.

a) $f(x) = \frac{x}{x^2 - 4}$

b)



6) Evaluate $f(x) = x^2 + 7x - 2$ using the difference quotient $f(x) = \frac{f(x+h) - f(x)}{h}$ $h \neq 0$.

7) Find the domain only for the following functions:

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

b) $g(x) = \frac{x + 4}{\sqrt{3 - x}}$

c) $h(x) = \frac{x}{x^2 - 9}$



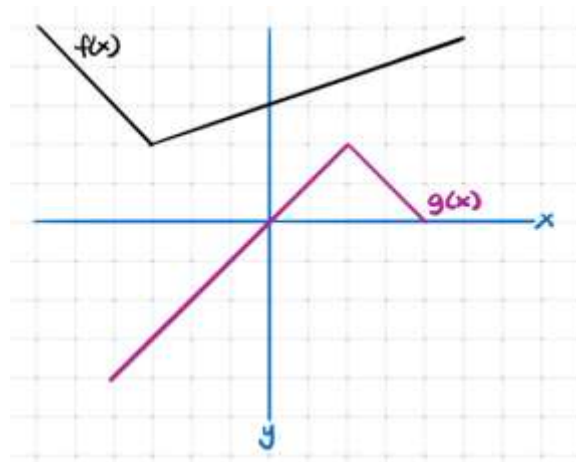
8) For $f(x) = x^3 - x$, answer the following questions:

- Find $f(3)$
- Is the point $(0,1)$ on the graph of $f(x)$? Justify your answer.
- If $f(x) = 0$, what value(s) of x ? What are the coordinates?
- What is the domain and range of $f(x)$?

9) Let $f(x) = \begin{cases} -x^3, & x < 1 \\ x, & x \geq 1 \end{cases}$, answer the following questions:

- Find $f(2)$, $f(-2)$ and $f(0)$.
- Provide a graph of $f(x)$.
- State the domain and range of $f(x)$.

10) Answer the following questions about $f(x)$ and $g(x)$ graphed below.



- $f(-3) + g(4)$
- $(f - g)(2)$
- $(g \circ f)(-5)$
- $(f \circ g)(0)$
- State the intervals where $f(x)$ is increasing and where $g(x)$ is decreasing.
- State the domain and range of $f(x)$ and $g(x)$.

11) Provide the equation and sketch of the graph of the following transformations:

- Absolute value function that is shifted upward 4 units from the origin.



- b) Square root function that is shifted to the right by 2 units from the origin.
- c) Parabola that is shifted to the left by 2 units and upward 2 units from the origin.
- d) Reciprocal function that is shifted downward 4 units from the origin.
- e) Absolute value function that is shifted to the right 3 units from the origin, downward by 3 units and reflected over the x-axis.
- f) Parabola that is shifted to the left by 5 units from the origin, upward 4 units and then reflected over the y-axis.

12) Given the function $h(x) = 2x^3 - 8x + 12$. Evaluate $h(3)$, $h(-3)$ and $h(7)$.

13) Let $f(x) = \frac{8x+6}{5x-2}$, find $f^{-1}(x)$.

Objective Two: Linear Equations

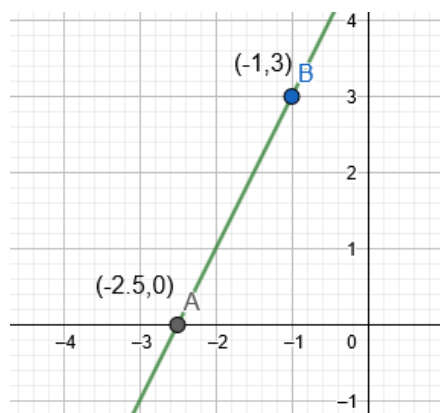
1) Find the equation of a line in slope intercept form that passes through the points (2,4) and (-3,2) Provide the graph of the line.

2) Given the points (3,8) and (5,-20), answer the following questions:

- a) What is the slope of the line that passes through the two points?
- b) What is the equation for the line in the general form for the two points?

3) Find the equation for a horizontal that passes through the point (2,-5).

4) Find the equation of the line graphed below:



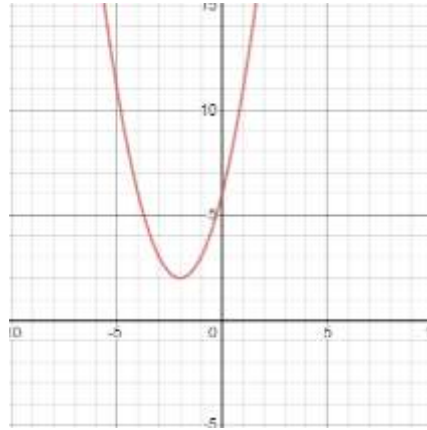
- 5) Write an equation for a line perpendicular to $y = 4x - 3$ and passing through the point (8,3).
- 6) Determine the equation of the line that is parallel to $y = -7x + 3$ and passes through (-1,-4).
- 7) Part a) Find the equation of a line that passes through points (-2,6) with a slope equal to 1. Part b) Find the equation of a line that is parallel to the line found in Part a, and that passes through points (-3,4). Graph both lines on the same coordinate axis.
- 8) Write in slope intercept form, the equation parallel and perpendicular to $y = \frac{3}{2}x + 3$, passing through the point (4,2).
- 9) Find the equation of the line that passes through the point (2,4) with a slope equal to $\frac{1}{8}$. Write your answer in slope intercept form.
- 10) Find the equation of a vertical line that passes through the point (9,-1).
- 11) Find the equation of a line that has a slope equal to 5, and passes through the point (-3,8).
- 12) Are any pair of lines are parallel and/or perpendicular for the following. Justify your answer.
- a) $2x + 2y = 8$ c) $y = 3x + 6$ d) $3y = x - 5$ b) $-(x - y) = 2$
- 13) Fill in the blanks:
- a) The slope of a horizontal line is _____
- b) The slope of a vertical line is _____
- c) Two lines are parallel if _____
- d) Two lines are perpendicular if _____

Objective Three: Polynomial and Rational Functions

- 1) State the vertex of the quadratic function $y = (x - 2)^2 + 4$. Find the intercepts and provide the graph of the function. What is the domain and range of the function?
- 2) For the following function $f(x) = 2x^2 - 5x + 3$, answer the question:
- a) What are the x and y intercepts?
- b) Find the Vertex.



- c) Graph
- d) Find the Domain and Range.
- 3) Provide the equation of the quadratic function graphed below.



4) For the function $f(x) = x^2 - 4x + 4$, do the following:

- a) What are the x and y intercepts?
- b) Find the Vertex
- c) Graph
- d) Find the Domain and Range.

5) Find the quadratic equation with a vertex $(2, -1)$ and passes through the point $(0, 7)$.

6) Answer the following questions about the functions below: a) Determine the degree and end behavior of the function. b) Find the intercepts. c) Determine if the graph touches or crosses at each of the x intercepts. d) At most how many turning points will there be in the graph of the function. e) Provide a rough sketch of the graph of the function.

a) $f(x) = x^2(x + 1)$

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

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

7) Determine a possible polynomial function $f(x)$ whose real zeros and degree are given:

- a) zeros: -1, 1, 3 (all zeros have multiplicity 1)
- b) zeros: -4 (multiplicity 1), -1 (multiplicity 2) and as $x \rightarrow \infty f(x) \rightarrow -\infty$
- c) zeros: 1 (multiplicity 2), -2 (multiplicity 2) and as $x \rightarrow -\infty f(x) \rightarrow -\infty$

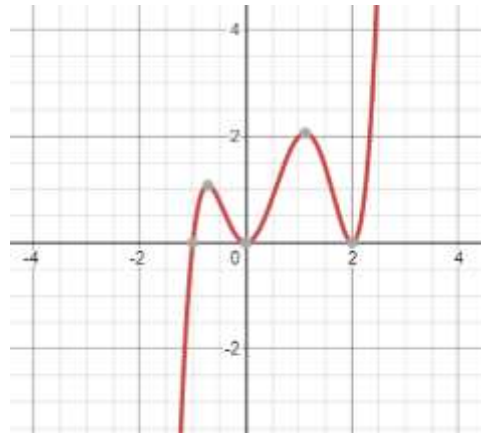


d) zeros: -5 (multiplicity 1), 2 (multiplicity 2) and as $x \rightarrow \infty f(x) \rightarrow \infty$

8) Which of the following polynomial functions might have the graph illustrated below.

(a) $x^2(x+2)^2(x-1)$ (b) $x(x-2)(x+1)^2$

(c) $x^2(x-2)^2(x+1)$ (d) $x(x+2)^2(x-1)$



9) Use the Rational Zero's Theorem to make a list of potential zeros of the following functions. Do not find the actual zeros.

a) $f(x) = 2x^5 - 6x^3 + 4x + 6$

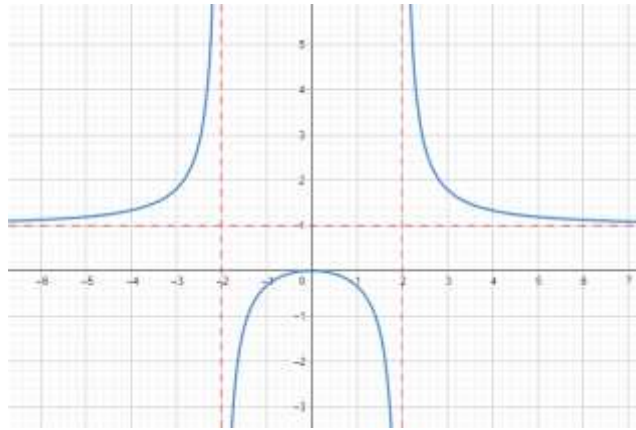
b) $g(x) = 3x^3 - 8x^2 + x - 18$

10) Use the Rational Zero's Theorem to make a list of potential zeros of the following functions, and find the actual zeros for $f(x) = x^3 + 3x^2 - 4x - 18$

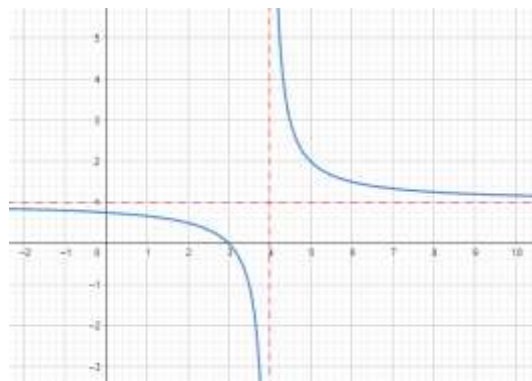
11) State the vertical and horizontal asymptotes for the graphed functions below.

(a)





(b)



12) State the vertical, horizontal and oblique asymptotes for the functions below.

a) $f(x) = \frac{x-1}{x^2-1}$

b) $f(x) = \frac{(x-7)}{(x+3)(x-4)}$

c) $f(x) = \frac{x^2+9x-1}{x+2}$

d) $f(x) = \frac{3(x^2-4)}{x^2+x-2}$

e) $f(x) = \frac{x^4-2}{x+8}$

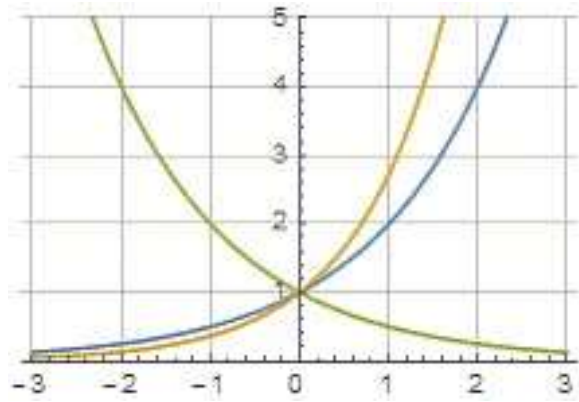
f) $f(x) = \frac{2}{x-6}$

Objective Four: Exponential and Logarithmic Functions

1) Three exponential function are graphed below. They are $f(x) = e^x$, $g(x) = 2^x$ and $h(x) = \left(\frac{1}{2}\right)^x$. Which one is f(x), g(x) and h(x)? Label the graphs.

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2) The graph of all exponential functions $f(x) = a^x$ (where $a > 0$; $a \neq 1$) are common in comparison to each other . What are three different characteristics the graph of exponential functions share? For example: All of them have are 1-1 functions.

3) Write as the sum and or difference of logarithms. Express powers as factors.

$$a) \log \frac{7\sqrt{x}}{3^x} \qquad b) \log_5 \frac{a^6 b^2}{\sqrt[3]{c+8}}$$

5) Solve for x for the following exponential and logarithmic equations.

a) $2^{2x+1} = 4^{-x-3}$

b) $\left(\frac{1}{9}\right)^x = 27$

c) $4e^x = 16$

d) $\log_2 x + 2 = 3$

e) $\log_3 (3x - 1) - \log_3(x + 2) = 1$

f) $\log_2 5x + 5 = \log_2 4x - 2$

g) $6^x = 17$

h) $\ln(x - 6) + (x + 6) = \ln 36$

i) $4 + \log_2 (x + 6) - \log_2 x = 8$



j) $\log(x+3) + \log(x-6) = 1$

k) $\ln \sqrt{4x - 8} = 2$

Objective Five: Trigonometric Identities and Equations

1) Find which quadrant the angle lies in:

- a) $\cos \theta > 0$ and $\cot \theta < 0$
- b) $\sin \theta > 0$ and $\tan \theta > 0$
- c) $\csc \theta > 0$ and $\cos \theta < 0$

2) Simplify the following trigonometric expressions to one (single) trigonometric function.

a) $\frac{\sec \theta}{\csc \theta}$

b) $\frac{\csc \theta}{\cot \theta}$

3) Given a point $(-2,4)$ on the terminal side of an angle θ , find the exact values of the six trigonometric functions.

4) Let $\tan \theta = -\frac{3}{2}$ with θ lying in the Quadrant II. Find $\cos \theta$.

5) Let $\sin \theta = -\frac{1}{\sqrt{5}}$ with $\cos \theta > 0$. Find $\tan \theta$.

6) Let $\cos \theta = \frac{3}{5}$ with $\sin \theta < 0$. Find $\cot \theta$

7) Prove the following Trigonometric Identities are true:

a) $\tan \theta \cot \theta - \cos^2 \theta = \sin^2$

b) $\frac{\tan \theta + \sec \theta}{\tan \theta \sec \theta} = \cos \theta + \cot \theta$

8) Let $f(x) = 2 \sin 4x$. Answer the following questions about $f(x)$:

a) What is the amplitude?



b) What is the period?

c) Provide the graph of $f(x)$ showing one full cycle.

9) Let $f(x) = -3 \cos 2\theta$. Answer the following questions about $f(x)$:

a) What is the amplitude?

b) What is the period?

c) Provide the graph of $f(x)$ showing one full cycle.

10) If $\cos \theta = -7/11$ and θ is in the 2nd quadrant, find $\sin \theta$.

