MATH 121 – Precalculus
Fall 2015

Final Exam
December, 10

Name: _____

UIN: _____

T/TH class time:: _____

email: _____

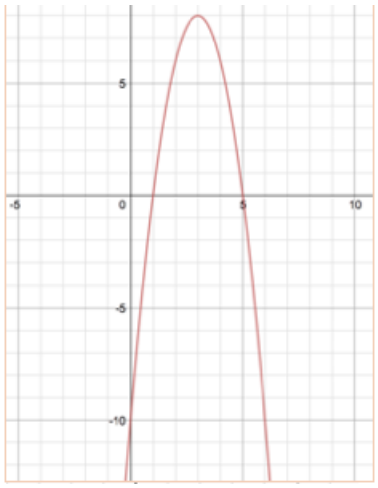
- You are expected to abide by the University's rules concerning Academic Honesty.
- You may *not* use your books, notes, or any electronic device including calculators and cell phones.
- Show ALL your work. Unsupported answers will not receive credit.
- Always state a complete answer to the problem.
- Do not write above the type at the top of any pages. If you do, your work may not be graded in that area, because the scanner may miss it. Please check that all the page numbers on each page of your exam match.

Circle your instructor and TA:

Cohen:	McClellan	Pant	Chase	White
Kashcheyeva:	Jiang	Alibek		
Thulin:	Sartipi	Du		
Lukina:	Davies	Li		
Ross:	Zielinski	Ngom	Meng	

---

1. Given the graph below of the quadratic equation $p(x)$, answer the following.



a. What is the vertex? Leave your answer in point form.

b. What are the x and y-intercepts?

c. What are the intervals of increase/decrease?

d. on what interval is $p(x) < 0$?

e. Find an equation for $p(x)$.

2. Given $f(x) = \sqrt{x-3} + 2$, write an equation for $g(x)$, if $g(x)$ is the graph of $f(x)$ shifted 6 spaces to the left and 5 spaces down.

3. Given $f(x) = e^{x+8}$ and $g(x) = \ln(2x+5)$, answer the following.

a. State the domain of $f(x)$.

b. Find $f^{-1}(x)$.

c. State the domain of $g(x)$.

d. Find $g^{-1}(x)$.

4. Given the rational function below, answer a - d, and use your answers to sketch a graph of $R(x)$.

$$R(x) = \frac{3x(x+2)}{(x+4)(x-3)}$$

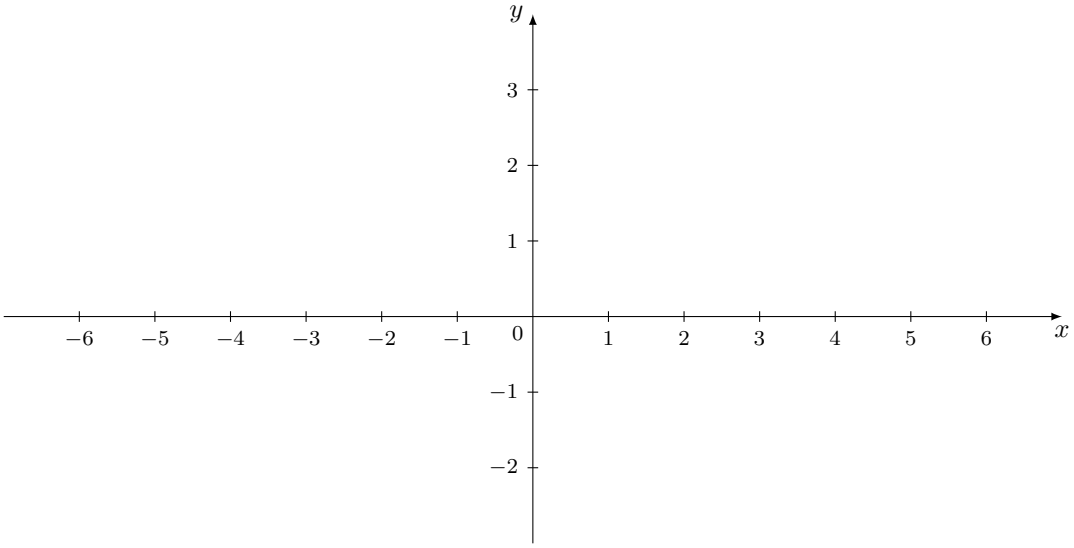
a. Determine the x-intercepts of $R(x)$. Leave your answers in point form.

b. Determine the vertical asymptotes of the graph.

c Determine the horizontal/oblique asymptote of the graph.

d. Determine the intervals where $R(x)$ is positive and where $R(x)$ is negative.

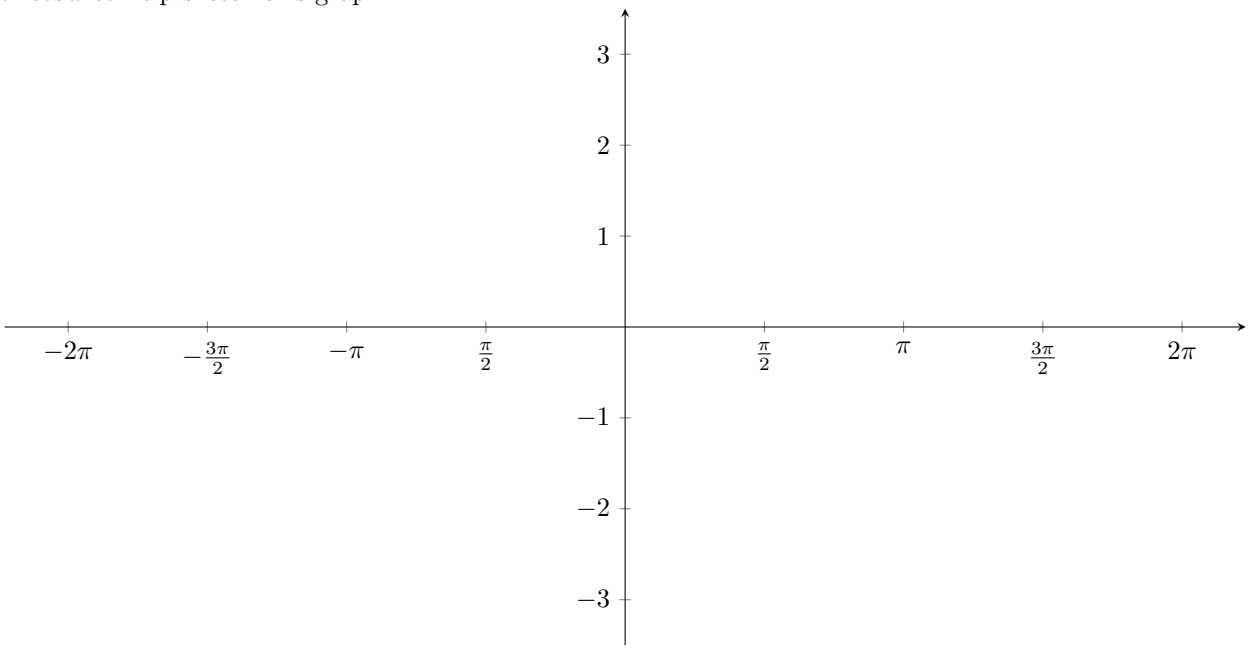
e. Use your answers above to sketch a graph of $R(x)$. This is a rough sketch; make sure it matches your answers above, but it does not have to be "perfect".



5. On the axes below

a. Sketch a graph of $f(x) = \cos x$. Include 2 periods.

b. On the same axes below, sketch a graph of $g(x) = \sec x$. Label your asymptotes. Be sure to use your graph of $\cos x$ to help sketch this graph.



6. Find the exact value of the following.

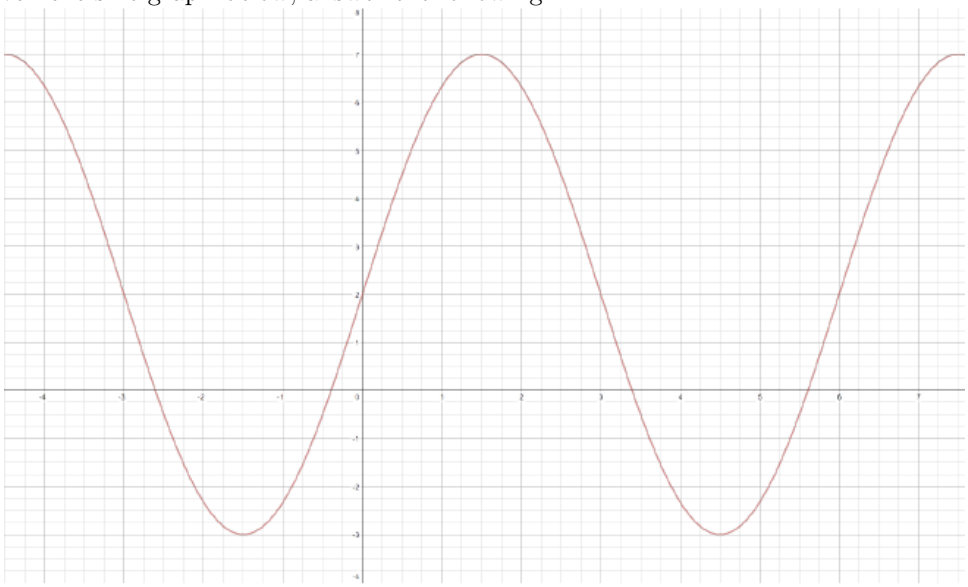
a. $\sin(-5\pi)$

b. $\tan(\frac{13\pi}{4})$

c. $\cos^{-1}(\cos(\frac{2\pi}{3}))$

d. $\sin(\frac{7\pi}{12})$

7. Given the sine graph below, answer the following.



a. What is the midline/vertical shift of the graph?

b. What is the amplitude?

c. What is the period?

d. Use your answers above to write an equation that fits this graph.

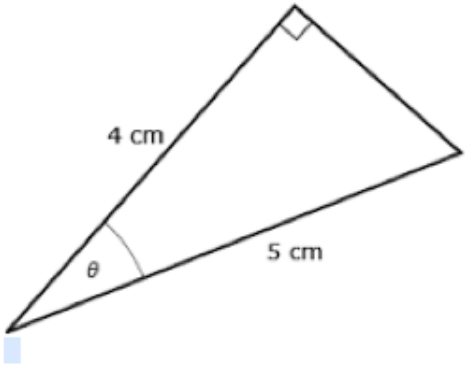
8. Find the general solution for the problem below.

$$2\cos(5x) + 1 = 0$$

9. Verify the identity.

$$\tan x \sin x + \cos x = \sec x$$

10. Given the triangle below, find the following. Remember to use double/half angle formulas when needed.



a. $\cos\theta$

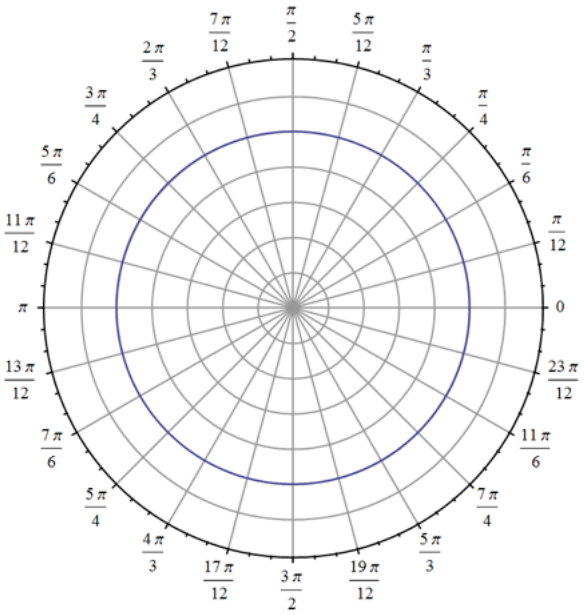
b. $\tan\theta$

c. $\tan(2\theta)$

d. $\cos(\frac{\theta}{2})$

11. Consider the polar coordinates $P(-2, \frac{\pi}{6})$, $Q(5, -\frac{\pi}{2})$.

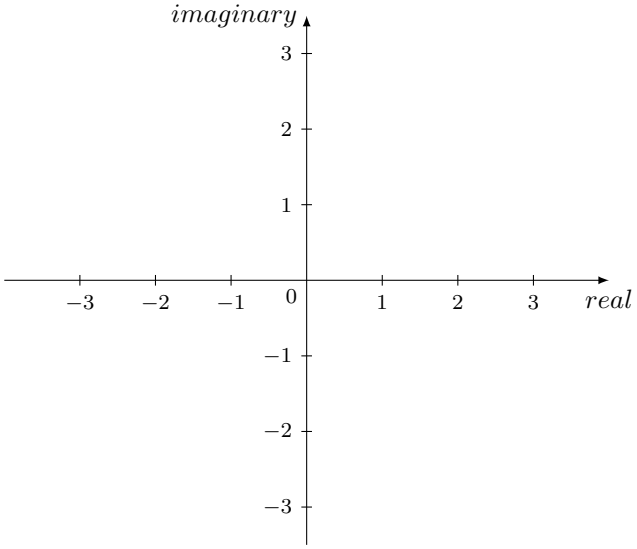
a. Plot P and Q.



b. Find the rectangular coordinates for P and Q.

12. GIven the complex number $z_1 = -3 + 3i$, answer the following.

a. Plot z_1 in the complex plane.



b. Find $\|z_1\|$. Please simplify your answer.

c. Write z_1 in polar form, $z = r(\cos\theta + i\sin\theta)$, with $0 < \theta < 2\pi$. Do not simplify your trigonometric values.

d. If $z_2 = \sqrt{2}(\cos(\frac{\pi}{8}) + i\sin(\frac{\pi}{8}))$, find $\dfrac{z_1}{z_2}$. Leave your answer in polar form.

13. Let $\mathbf{w} = \langle -4, 5 \rangle$ and $\mathbf{v} = \langle 1, -3 \rangle$.

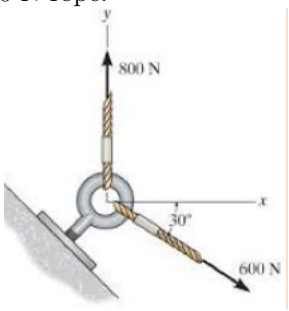
a. Compute $2\mathbf{w} + 3\mathbf{v}$.

b. Find the magnitude of $2\mathbf{w} + 3\mathbf{v}$.

c. Find the unit vector in the direction of $\mathbf{v}$.

d. Find $\mathbf{w} \cdot \mathbf{v}$

14. wo ropes are attached to an anchor as seen below. One acts with a force of 800 N, and the other with a force of 600 N. Let $\mathbf{F_1}$ be the vector representation of the 800 N rope, and $\mathbf{F_2}$ be the vector representation if the 600 N rope.



a. Find the vector representation for $\mathbf{F_1}$ and $\mathbf{F_2}$. Please simplify your answers, leaving them in the form $\mathbf{F} = a\mathbf{i} + b\mathbf{j}$.

b. Find the vector representation for the resultant force, $\mathbf{F_1} + \mathbf{F_2}$.