

Precalculus Final, Spring 2014

Name _____

Section, Instructor, or class time of day _____

SHOW SUPPORTING WORK!! Little or NO CREDIT will be given unless appropriate supporting work is displayed (except on one-step problems). You must use "algebraic" methods whenever possible. If (and only if) no algebraic method works, guess-and-check is legal and expected. As usual, give answers to at least 3 significant digits.

1. (No work need be exhibited. Answers with fewer than 3 correct significant digits will not get full credit.)

Let $c = -3.4$. Evaluate:

$$\frac{c + \sqrt{c^2 + 9}}{(\pi - 3)(c - 2)} =$$

2. Short answer:

a) You look at a graph in the standard window and you wish the graph would appear twice as far from the y -axis. How do you change the window to get what you want? [Fill in the two blanks.]

"Change the ___-interval to _____"

b) Give the distance from $(c, 6)$ to $(2, d)$.

3.a) If f is defined by $f(x) = 3x - 1$. Find $f(f(x))$. Simplify.

b) State, in algebraic notation (as in Section 1.4 on reading and writing math), the method for evaluating all expressions similar to these in terms of simpler operations: $(4/11)/7$. $(7/3)/4$.

4. The graph of the quadratic $k(x - 4)(x + 3)$ goes through the point $(2, 7)$. Find k .

Problem	Points	Score
1	8	
2	8	
3	6,6 = 12	
4	6	
5	6	
6	12	
7	10	
8	15	
9	12	
algebra	(of 89)	
10	4@ = 28	
11	8	
12	15	
13	8	
14	8	
15	5,5,8	
16	8	
17	8	
18	10	
trig	(of 111)	
Total	200	

5. Solve for x (as always, algebraically if possible, and show work!)

$$\frac{x^6}{x^2} = 50\sqrt{x}.$$

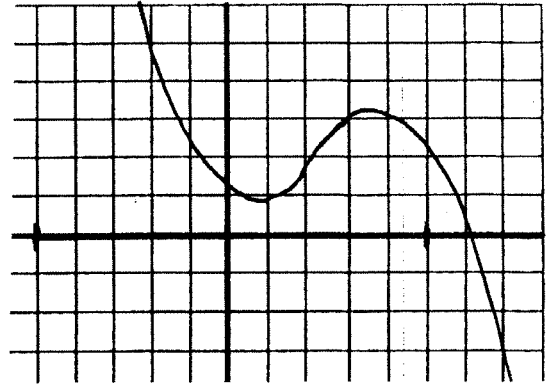
6. Suppose you know just three things about f : $f(5.4) = 8.2$, $f(6.6) = 6.1$, and $f(7.9) = 4.6$.

We want to approximate the function with a line in order to approximate the solution to $f(x) = 5.8$.

a) Give the formula for the most relevant line.

b) Use the line to approximate the solution to $f(x) = 5.8$.

7. From 2008 to 2014 Wealthstock went up 160%. That is a very large gain. From 2008 to 2010 it went up 295%. That was an amazingly high gain. What was the change in Wealthstock from 2010 to 2014?



8. Grid lines are one unit apart and the graph is representative.
[Close is good enough.]
- Solve $f(x) = 3$
 - Solve $f(x) = 2f(5)$.
 - On the same axis-system, sketch the graph of $f(2x)$.

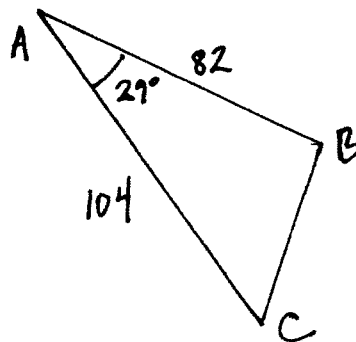
9. [Assume exponential growth.] The biomass of algae increases 30 percent every two hours. How long does it take the biomass to triple?

Part II: Trigonometry. Set your calculator to DEGREE mode to start. Switch to radian mode when appropriate. For your information: Law of Cosines: $c^2 = a^2 + b^2 - 2ab \cos C$.

Law of Sines: $(\sin A)/a = (\sin B)/b$. $\sec \theta = 1/(\cos \theta)$, $\csc \theta = 1/(\sin \theta)$, $\cot \theta = 1/(\tan \theta)$.

10. a) Solve $\sin \theta = -.3$ for θ in degrees in the third quadrant. [Is your calculator in **degree** mode?]
- Find $\sec 72^\circ$.
 - Solve $\csc x = 4.4$ (for x in the first quadrant).
 - Give the reference angle of 205 degrees.
 - Exactly how many degrees are in 1 radian (do not give a decimal answer).
 - (In radians) How many solutions does $\sin(3x) = .4$ have in the interval $[0, 2\pi)$?
 - A triangle has sides $a = 13$, $b = 5$, and $c = 12$. Is it a right triangle? (Yes or no.)

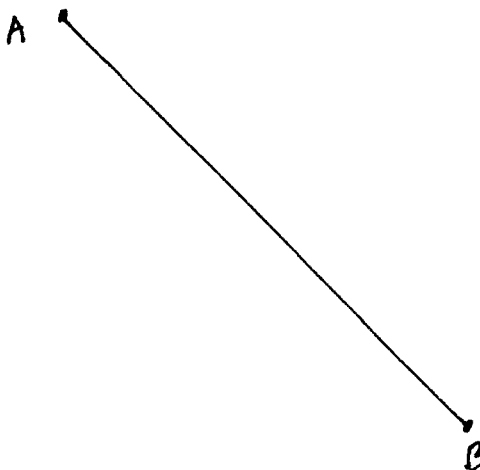
11. Find angle B in the pictured triangle.
(The parts are 82, 29° , and 104.)



12. [See the partial picture which you will have to complete.] If the given data makes for ambiguous results, be sure to find all answers compatible with the given data.

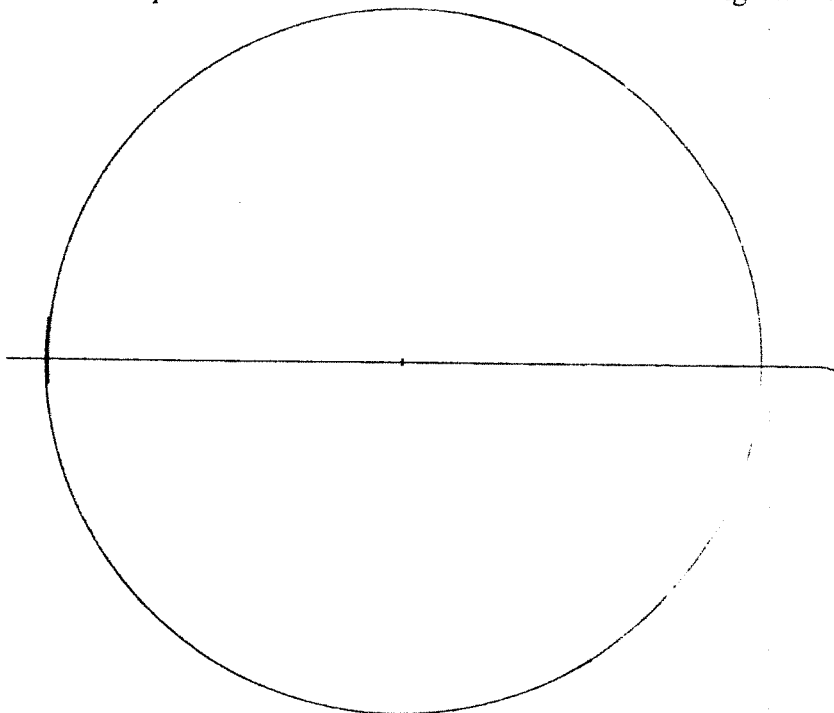
From A to B 3.50 miles S 46° E. The bearing from A to C is S 80° E. The distance from B to C is 2.00 miles. Find the distance from A to C.

Correct numbers are not enough. You **MUST** write enough to demonstrate you know how to do it. **First** sketch in the location of C. Then, make a clear plan we can easily follow. Label your steps (1), (2), (3), etc. and state what law you are using at each step. Make clear which is your final answer.



13. Find $\tan(\sin^{-1}(x/3))$ in terms of x when the angle is in the first quadrant.
[Hint: Draw a picture.]

14. a) Sketch and fully label an excellent and illuminating unit-circle picture to determine and illustrate a trig identity for $\cos(\theta + \pi/2)$. Be sure to label the angle $\theta + \pi/2$ b) Give the usual identity for $\cos(\theta + \pi/2)$. [The identity alone will be worth little. The picture will be marked on how illuminating and how completely labeled it is.]

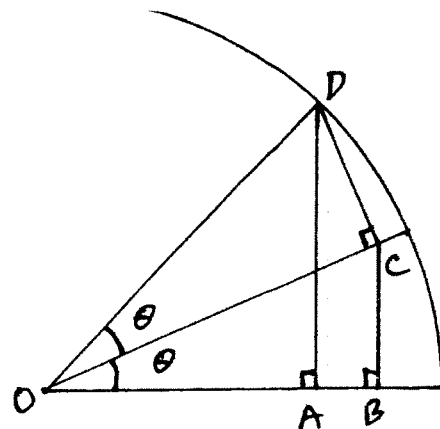


15. In the unit-circle picture, the two angles labeled θ are equal. Three of the angles are marked as right angles. Find, in terms of θ ,

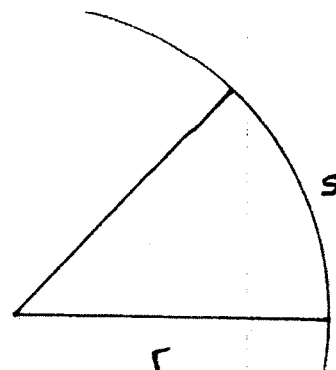
a) OC

b) BC

c) [Show sufficient work.] If $OA = .63$, find DC.



16. A sector (pie-shaped piece) of a circle has radius r and arc-length s . Derive the formula for the area of the sector, in terms of r and s . [The correct answer with no derivation will be worth little. You may assume we know the area of a circle and the circumference of a circle, but do not use more-sophisticated formulas.]



17. Here are identities you may wish to use in this problem:

$$(7.3.3A) \quad \sin 2\theta = 2(\sin \theta)(\cos \theta)$$

$$(7.3.3B) \quad \cos 2\theta = \cos^2 \theta - \sin^2 \theta$$

$$(7.3.3C) \quad \cos 2\theta = 1 - 2 \sin^2 \theta$$

$$(7.3.3D) \quad \cos 2\theta = 2 \cos^2 \theta - 1.$$

Derive the “squared-function” identity for $\sin^2(\theta)$ that we derived from one of these. [Derive the usual one, the one we derived. Make sure it is not the one that comes from $\sin^2(\theta) + \cos^2(\theta) = 1$.] [Giving the identity without the steps in the derivation is worth zero.]

18. Solve algebraically for θ in the first quadrant: $(\cos \theta)^2 = \sin \theta - 0.2$
 [Use degree mode on your calculator.]