

### Math 150 Exam 3 Review Problem Set

Note: This exam review does not cover every topic that could be covered on your exam.

Take a look at the previous Week in Reviews for more practice problems. This WIR is more heavily weighted on Sections 7.4-7.5 & 8.4-8.5 since there has not been a review on these sections yet.

(Problems 12 and 16 were taken or modified from *Precalculus* by Dugopolski.)

1. Evaluate the following.
  - (a)  $\cos^{-1}(-\frac{1}{2})$
  - (b)  $\sin^{-1}(-\frac{\sqrt{2}}{2})$
  - (c)  $\tan^{-1}(\tan \frac{4\pi}{3})$
  - (d)  $\csc(\sec^{-1} \frac{9}{2})$
  - (e)  $\sec(2 \tan^{-1} \frac{1}{2})$
2. Express  $\sin(2 \cot^{-1} x)$  as an algebraic expression in  $x$ .
3. Find all solutions to the following trig equations.
  - (a)  $2 \cos^2 u = 1 - \cos u$
  - (b)  $3 \tan^3 x - 3 \tan^2 x - \tan x + 1 = 0$
  - (c)  $\sin \frac{x}{5} = \frac{1}{\sqrt{2}}$
4. (i) Find all solutions to the equation. (ii) Find all solutions in the interval  $[0, 2\pi)$ .  
 $\sin 100x \cos 96x - \cos 100x \sin 96x = -\frac{1}{2}$
5. A vector  $\mathbf{u}$  has initial point  $(-4, 3)$  and terminal point  $(-1, -2)$ , and  $\mathbf{v} = \langle 7, 2 \rangle$ .
  - (a) Calculate  $\mathbf{u} + \mathbf{v}$
  - (b) Calculate  $|\mathbf{v} - 2\mathbf{u}|$
  - (c) Calculate  $\mathbf{u} \cdot \mathbf{v}$
  - (d) Find the angle between  $\mathbf{u}$  and  $\mathbf{v}$  to four decimal places.
  - (e) Find a unit vector that has the same direction as  $\mathbf{v}$ .
6. If  $|\mathbf{v}| = 3$  and  $\theta = 210^\circ$ , what is the vector  $\mathbf{v}$  in component form?
7. Find the direction of the vector  $\mathbf{u} = \langle -2, 5 \rangle$  to four decimal places.
8. A boat is traveling at 15 mi/hr with a bearing of S  $30^\circ$  W relative to the water. The water is flowing due north at 3 mi/hr.
  - (a) What is the true velocity of the boat?
  - (b) What are the true speed and bearing of the boat?
9. Let  $\mathbf{u} = -9\mathbf{i} + 5\mathbf{j}$  and  $\mathbf{v} = a\mathbf{i} - 6\mathbf{j}$ . Find the value of  $a$  that would make these vectors orthogonal.
10. A telephone pole is anchored to the ground by 2 wires, one on each side. One wire has an angle of elevation of  $40^\circ$ . The other wire is 10 ft longer and has an angle of elevation of  $35^\circ$ . How tall is the pole?
11. Jack and Jill set sail from the same point. Jack travels in the direction S  $4^\circ$  E and Jill travels in the direction S  $9^\circ$  W. After 4 hours, Jill is 4 miles due west of Jack. How far had Jill sailed?

12. Solve the following triangles.
- (a)  $A = 60^\circ, b = 10, c = 12$
  - (b)  $A = 24^\circ, a = 9, c = 18$
13. Suppose that  $\sec x = \frac{4}{3}$  and that  $x$  is in Quadrant IV.
- (a) Find all other trig values of  $x$ .
  - (b) Find all trig values of  $2x$ .
14. Verify the following identities:
- (a)  $\frac{\frac{\sec x}{\tan x} - \frac{\tan x}{\sec x}}{\cot x} = \cos x$
  - (b)  $\tan \frac{u}{2} \left( \csc \left( \frac{\pi}{2} - u \right) + 1 \right) = \tan u$
15. Find the exact value of  $\sin(x - y)$  given that  $\sin x = -\frac{4}{5}$  and  $\cos y = \frac{12}{13}$  with  $x$  in Quadrant III and  $y$  in Quadrant IV.
16. Find  $\cos(285^\circ)$  by using an Addition or Subtraction Formula.
17. Use a Sum-to-Product Formula to evaluate  $\sin 285^\circ - \sin 15^\circ$ .
18. Find the exact value of  $\cos 105^\circ$  using a Half-Angle Formula.
19. If  $\tan x = -\frac{\sqrt{7}}{3}$  and  $270^\circ < x < 360^\circ$ , find  $\sin \frac{x}{2}$ ,  $\cos \frac{x}{2}$ , and  $\tan \frac{x}{2}$ .
20. The wheel from “Wheel of Fortune” is spun while you are sitting on the edge. Suppose the wheel has a radius of 5 ft and is spinning at a rate of 20 rpm.
- (a) What is the angular speed of the wheel?
  - (b) At what speed will you fly off the wheel if it stops suddenly?
  - (c) If one piece on the wheel subtends an angle of  $10^\circ$ , what is the area of this piece?