Show all the work necessary to solve the problems. Circle your answers to each problem clearly. WRITE ANSWERS ON YOUR OWN PAPER, EXCEPT FOR THE GRAPHS WHICH MAY BE PLOTTED ON THE BACK. You may use calculators. Point values of each problem are indicated in parentheses. The total is 100 points.

1. (a) (5) Convert \( \frac{7\pi}{12} \) radians to degrees.
   (b) (5) Convert \(-135^\circ\) to radians. Leave your answer as a multiple of \( \pi \).

2. (10) Find the exact value of \( \tan \frac{9\pi}{4} \). (Decimal approximations receive no credit.)

3. (10) Find all exact values of \( s \) in radians such that \( \cos s = \frac{1}{2} \) and \( s \) is in \([0, 2\pi]\).

4. Suppose a satellite is moving in a circular orbit centered around the earth with an angular velocity of \( \omega = 2\pi \) radians per day. In order to stay in that orbit, the linear velocity \( v \) must satisfy \( v^2 = \frac{K}{r} \) where \( r \) is the radius of the orbit and \( K = 400,000 \text{ km}^3/\text{sec}^2 \).
   (a) (5) State the relation that holds between \( \omega, r \) and \( v \) in general.
   (b) (5) Find the radius \( r \) in kilometers. (Note: a day has 86,400 seconds.)

5. (10) For the function \( y = 1 - 2\sin(3x) \), answer the following questions (do not graph the function):
   (a) What is the period?
   (b) What is the amplitude?
   (c) What is the frequency?
   (d) What is the maximum value?
   (e) What is the minimum value?

6. (10) Determine all the vertical asymptotes in the interval \([0, 2\pi]\) for the function \( y = -\sec(x - \frac{\pi}{4}) \). (Do not graph!)

7. (10) Graph the function \( y = 3 - 3\cos(2x - \pi) \) on the interval \([0, 2\pi]\). Mark the scales clearly on your axes, and identify all the places the graph touches the \( x \) axis.

8. (10) Graph one period of the function \( y = -2\tan\left(\frac{x}{2}\right) \). Mark all vertical asymptotes.

9. (10) Suppose \( \cos x = -2/3 \) for \( x \) in Quadrant II. Determine \( \csc x \) using basic identities.

10. (10) Use the basic identities to express \( \frac{\sec \theta}{\tan \theta} \) in terms of \( \sin \theta \) and \( \cos \theta \), and then simplify as much as possible.

\( \text{(turn page)} \)
Answer to problem 7

Answer to problem 8