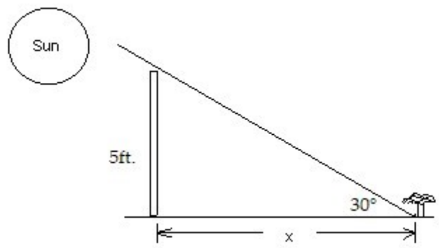
FINAL EXAM
TRIGONOMETRY
MATH 1321
TUESDAY DECEMBER 11TH

There are fourteen questions. **Calculators are not allowed**. Answers may be written in terms of multiples of π when convenient and appropriate. Answers may also be written in terms of surds (e.g. $\sin 45° = \frac{1}{\sqrt{2}}$) when convenient.

(1) (10 points)
  (a) One angle of a triangle has measure $23°40'$ and another angle has measure $41°19'$. Find the measure of the third angle in **degrees, minutes, seconds**.
  (b) Find the values of the six trigonometric functions for the angle θ in standard position having the point $(-4, 3)$ on its terminal side.

(2) (5 points)
On a sunny day, a flag pole and its shadow form the sides of a right-angle triangle. If the hypotenuse is 13 meters long and the shadow is 12 meters, how tall is the flag pole?

(3) (5 points)
In one area, the lowest angle of elevation of the sun in winter is $30°$. Find the minimum distance x that a plant needing full sun can be placed from a fence that is 5 feet high.



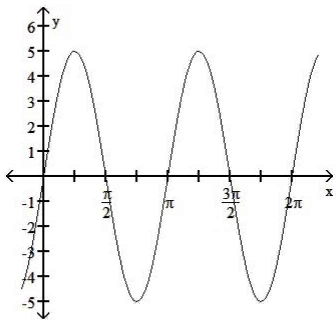
(4) (10 points)
  (a) Convert each degree measure to radians.
    (i) $135°$
    (ii) $-540°$
  (b) Convert each radian measure to degrees.
    (i) $\frac{11\pi}{6}$
    (ii) $-\frac{3\pi}{4}$

(5) (10 points)
  (a) Find the exact value of $\tan\left(\frac{5\pi}{3}\right)$ by showing all steps.
  (b) Give the exact value of s in the interval $\left[\pi, \frac{3\pi}{2}\right]$ such that $\cos s = -\frac{\sqrt{3}}{2}$ by showing all steps.

(6) (10 points)
A satellite traveling in a circular orbit 2000km above the surface of Earth takes 3hr to make an orbit. The radius of Earth is approximately 6400km.
  (a) Find the linear speed of the satellite in kilometers per hour.
  (b) Find the distance the satellite travels in 3 hours.

(7) (5 points)
Graph the function
$$y = 1 + \sin(2x - \pi)$$
over a one-period interval.

(8) (5 points)
The function graphed is of the form $y = a\sin(bx)$ or $y = a\cos(bx)$, where $b > 0$. Determine the equation of the graph.



(9) (5 points)
Rewrite each expression as a single function of an angle.
(a) $\sin 173^\circ \cos 82^\circ + \cos 173^\circ \sin 82^\circ$
(b) $\cos 86^\circ \cos 73^\circ + \sin 86^\circ \sin 73^\circ$
(c) $\dfrac{\tan 87^\circ - \tan 21^\circ}{1 + \tan 87^\circ \tan 21^\circ}$

(10) (10 points)
Use identities to find the exact values of the followings:
(a) $\sin(-105^\circ)$
(b) $\tan 112.5^\circ$
(c) $2\cos^2 22.5^\circ - 1$

(11) (10 points)
Solve the following equation in the interval $[0, 2\pi)$.
$$3\sin^2\theta - \sin\theta - 4 = 0.$$

(12) (5 points)
Two boats leave a harbor at the same time, traveling on courses that make an angle of 120° between them. When the slower boat has traveled $60\,km$, the faster one has traveled $80\,km$. At that time, what is the distance between the boats?

(13) (5 points)
Find the product of the following complex numbers and write the product in rectangular form, using exact values.
$$3\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right) \times 2\left(\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}\right).$$

(14) (5 points)
Find the quotient of the following complex numbers and write the answer in rectangular form.
$$\frac{20\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)}{4\left(\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}\right)}$$