Homework 10 - Math 141, Frank Thorne (thornef@mailbox.sc.edu)

Due Friday, October 28

Credits: Some questions are taken from Arun Ram's calculus notes; see `http://www.ms.unimelb.edu.au/~ram/Teaching/2006Fallmath221/HW8F06.pdf`

For all the graphing problems, explicitly describe each of the following when relevant to your graph.

(1) Where are the x- and y-intercepts?

(2) Where is the graph positive and negative?

(3) Where are the critical points?

(4) Where is the graph increasing and decreasing?

(5) Where are the inflection points?

(6) Where is the graph concave up and concave down?

(7) Where are the asymptotes? (If $f(x)$ has asymptotes)

(a) Stewart, Ch. 4.5; 1-14, 25-38, 41-48; even required, odd recommended.

(b) Graph $f(x) = 2\cos x + \sin 2x$.

(c) Graph $f(x) = 2\sin x + \cos 2x$.

(d) Graph $f(x) = e^{-x}$.

(e) Graph $f(x) = e^{-x^2}$.

(f) Graph $f(x) = \ln(4 - x^2)$.

> **Related rates warmup questions**. These exercises don't involve any calculus. For each of them, write an equation which relates the two expressions described. Be sure to **draw a picture** and **explain what your variables stand for**.
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> **Note:** A couple of the questions contain *red herrings:* information which is not needed to answer the question.

(g) Relate the area of a circle to its diameter.

(h) Relate the volume of a cylinder of radius 1 to its height.

(i) The bottom of a rectangular swimming pool is 30×50 feet. Relate the depth of the water in the pool to its volume.

(j) A woman is standing at some distance from a 20 foot tall pole. A streetlight is on top of the pole. Relate the length of her shadow to the distance between the woman and the height of the pole.

(k) A lighthouse is on a small island 3 km away from the nearest point P on a straight shoreline and its light turns four revolutions per minute. Relate the position of the light on the shoreline to the direction of the light.

(l) A 10 foot ladder rests on a wall and is sliding down the wall (and the bottom is sliding away from the wall). Relate the angle between the top of the ladder and the wall, and the height of the top of the latter.

(m) In the previous question, relate the height of the top of the latter to the distance of the bottom of the ladder from the wall.

(n) A television camera is positioned 4000 ft from the base of a rocket launching pad. A rocket rises vertically. Relate the distance between the rocket and the camera to the height of the rocket.

(o) In the previous question, relate the camera's angle of elevation to the height of the rocket.

(p) A man starts walking north at 4 ft/s from a point P. Five minutes later a woman starts walking south at 5 ft/s from a point 500 ft due east of P. Relate the distance between the man and the woman and the time the man has been walking.

(q) In the previous problem, relate the distance between the man and the woman and the time the woman has been walking.

(r) In the previous question, relate the distance between the man and the woman and the distance travelled by the man.