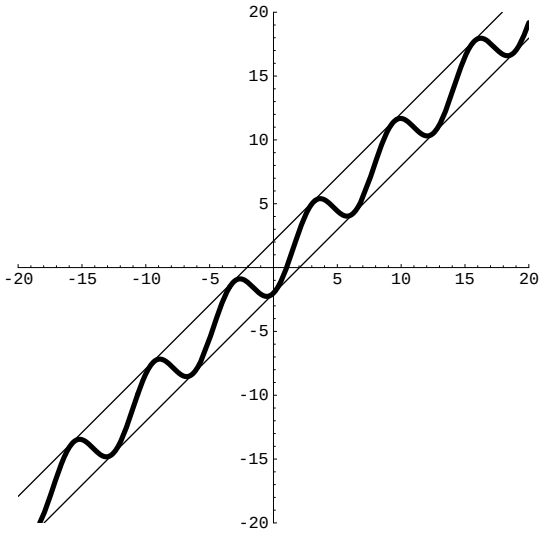
HOMEWORK #6

1. Stewart, section 3.5: #9,10,13,18,22,23,42,43,46,48(a),67,70(a,b).
2. Stewart, section 3.6: #1,3,5,9,11,16, 21,27,29,35,43,45,63,69.
3. Stewart, section 3.7: #1,3,5,9,11,25,31,42,45,47,51,55.
4. The graphs of $y = x - 2\cos(x)$ and two parallel tangential lines are given below. Write the equations of each of the two lines.

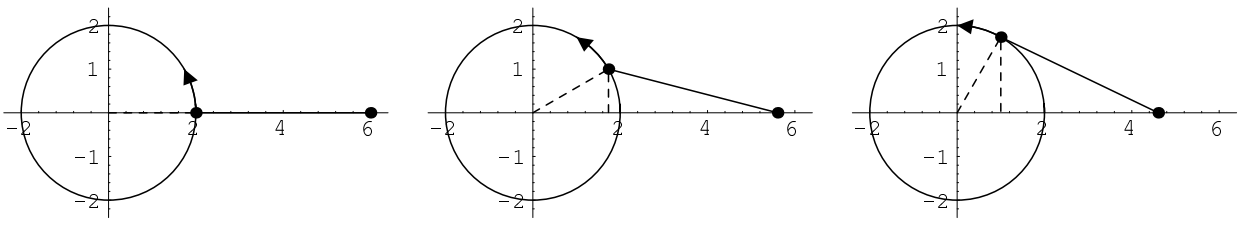


5. A 4-centimeter rod is attached at one end A to a point on a wheel of radius 2 cm. The other end B is free to move back and forth along a horizontal bar that goes through the center of the wheel. At time $t = 0$ the rod is situated as in the diagram at the left below. The wheel rotates counterclockwise at 3 1/2 rev/sec. Thus, when $t = 1/21$ sec, the rod is situated as in the diagram at the right below.

   (a) How far is the right end of the rod (the point B) from the center of the wheel at time $t = 1/21$ sec?

   (b) Express the position of the right end of the rod as a function of t.

   (c) Express the speed of the right end of the rod as a function of t.



6. You are on a ferris wheel. As the wheel rotates, your height above the ground at time t seconds is given by the sinusoidal function

$$y(t) = 50\sin(\frac{\pi}{10}(t-5)) + 52\text{ft}.$$

(a) Where are you initially located (at time $t = 0$)?

(b) Find the vertical velocity $y'(t)$ and vertical acceleration $y''(t)$. What is the maximum/minimum vertical velocity?

(c) During one revolution, when will your vertical velocity be 10 ft/sec? When will it be -10 ft/sec? Where are you located when this happens?

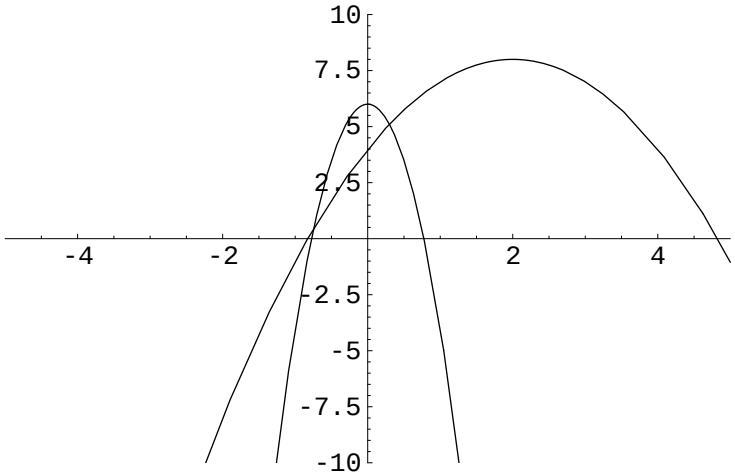
7. The graphs of the quadratic functions

$$f(x) = 6 - 10x^2$$

and

$$g(x) = 8 - (x-2)^2$$

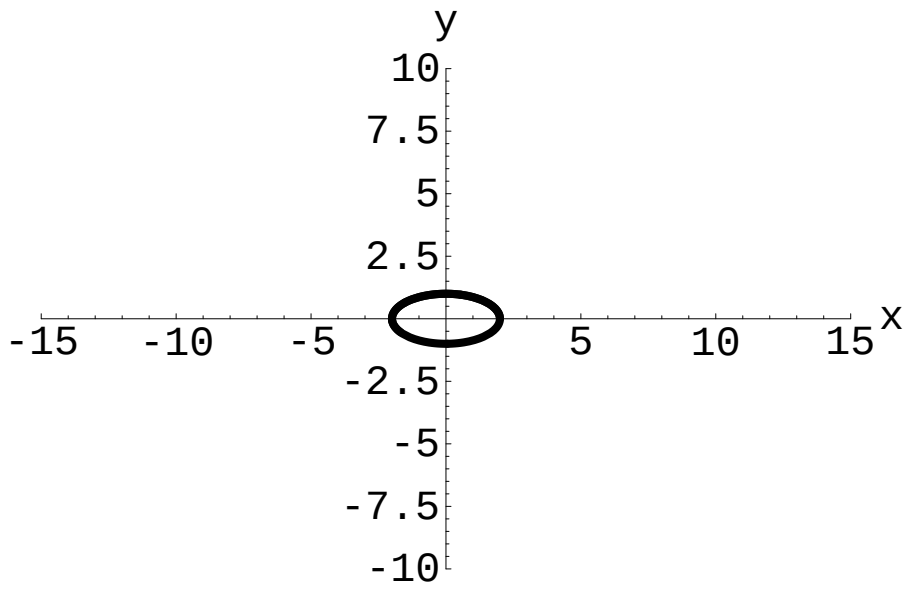
are provided below. Find the lines simultaneously tangent to both graphs;i.e. find the equations of all such lines.



8. An object is moving around an ellipse according to the parametric equations

$$\begin{aligned} x(t) &= 2\cos(5t) \\ y(t) &= \sin(5t), \end{aligned}$$

where t has units of seconds and the coordinate axes have units of feet. The location of the object at time t will be $P(t) = (x(t), y(t))$ and the graph of this motion is given below:



(a) Locate and compute the coordinates of $P(0), P(0.5)$ and $P(1)$ in the picture.

(b) Compute the horizontal velocity $x'(t)$ and vertical velocity $y'(t)$. What are the maximium (minimum) vertical and horizontal velocities?

(c) During the first trip of the object around the ellipse, find where the object is located when it has vertical velocity 3 ft/sec.

(d) During the first trip of the object around the ellipse, how much of the time will the horizontal velocity exceed 8 ft/sec?

(e) Plot the point $Q(1) = (x(1) + x'(1), y(1) + y'(1))$ and find the equation of a line through the points $P(1)$ and $Q(1)$. Draw this line in the picture. What can you say about this line?

(f) Plot the point $Q(0.5) = (x(0.5) + x'(0.5), y(0.5) + y'(0.5))$ and find the equation of a line through the points $P(0.5)$ and $Q(0.5)$. Draw this line in the picture. What can you say about this line?