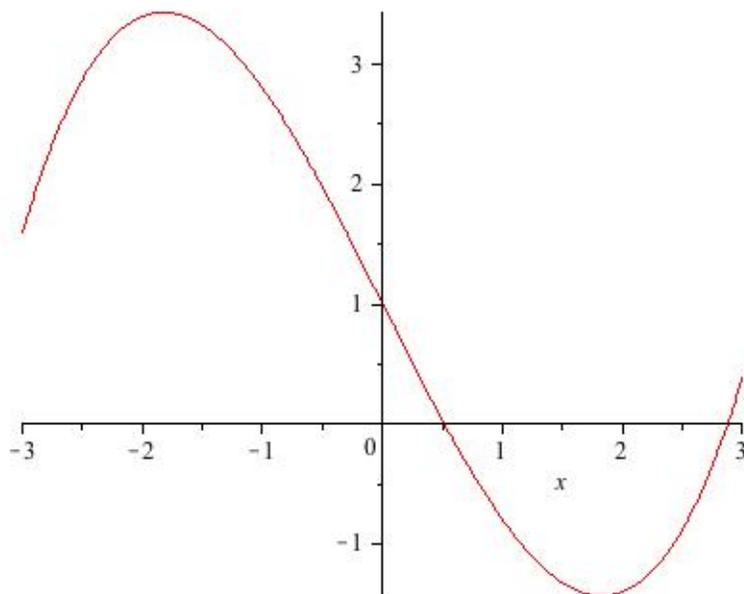


Math 110, Spring 2015
HWK00 due FRI 23 January

1. A graph of the function f is shown. On the same graph, sketch the functions

- (a) $f(x + 1)$;
- (b) $f(x/2)$;
- (c) $f(x) - 2$;
- (d) $(2/3)f(x)$.

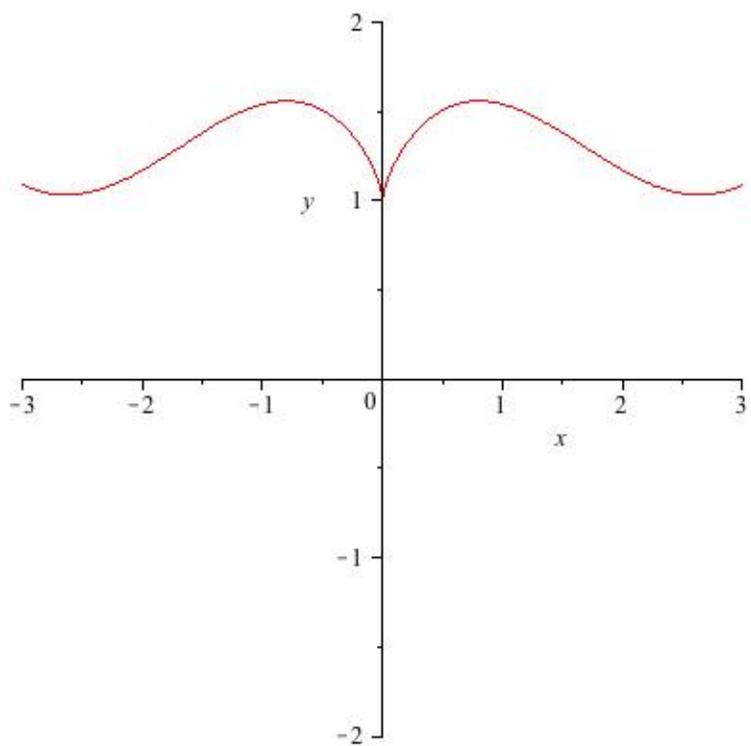


2. A graph of the function $\cos(x) + x^{2/3}$ is shown. On the same graph, sketch the functions

(a) $\cos(x - 1) + (x - 1)^{2/3}$;

(b) $\cos(2x) + (2x)^{2/3}$;

(c) $\cos(x) + x^{2/3} - 2$;



3. Sketch the following functions on enough of the domain to get an idea of the shape of the graph.

(a) $\sin(x^2)$

(b) $\sin(x)/x$

(c) xe^{-5x}

(d) $x - \lfloor x \rfloor$

(e) $1/(1+x^2)$

(f) $\sqrt{1+x^2}$

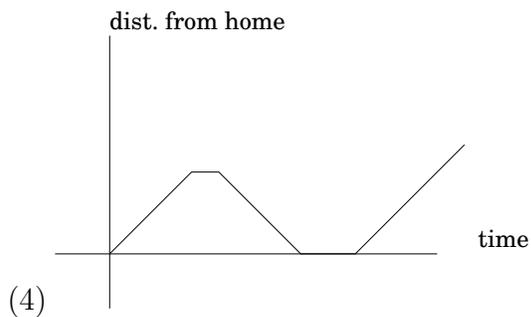
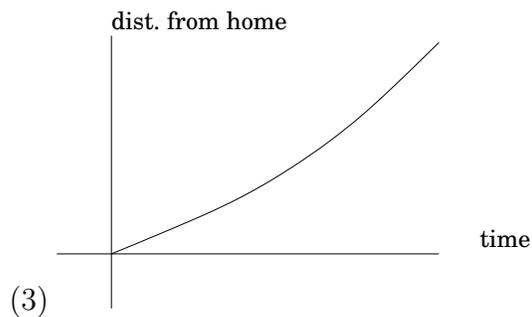
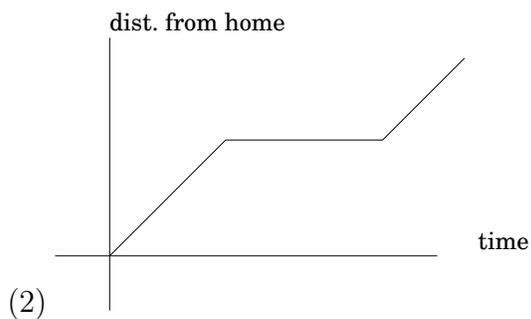
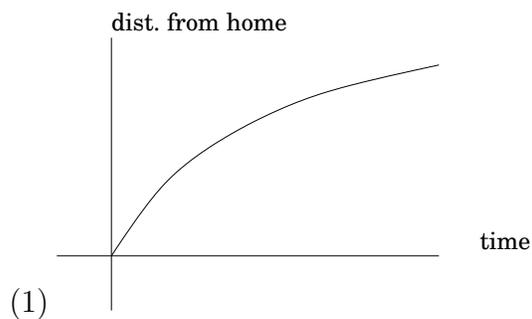
(g) $x^3 - x$

(h) x^2e^{-x}

4. (Adapted from Hughes-Hallett et al., Section 1.1, Problem 34)

Which graph best matches each of the following stories. Write a story for the remaining graph.

- (a) I had just left home when I realized I had forgotten my books, so I went back to pick them up.
- (b) Things went fine until I had a flat tire.
- (c) I started out calmly but sped up when I realized I was going to be late.



5. In each case, write a formula representing the function. Please choose appropriate notation and define it explicitly. Also please give units for the variables in the formula and for any constants of proportionality.

(a) The energy expended by a swimmer is proportional to the mass of the swimmer and the cube of her speed.

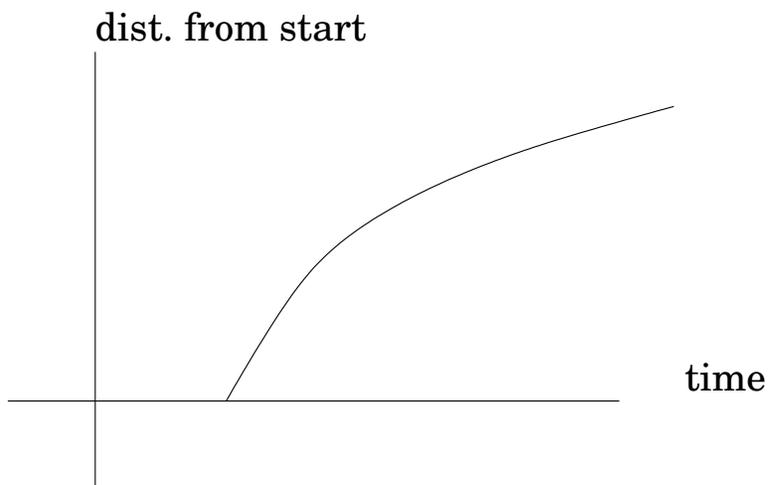
(b) The change in demand for new cars, as a portion of present demand, is linear in the percentage change in gas prices.

(c) The amount (in cubic centimeters) of extractable water underneath each square centimeter of soil is proportional to the maximum drilling depth, and inversely proportional to the alkalinity, α .

6. Within a species, the surface area of an animal (which determines how rapidly it loses heat) is proportional to the square of its length and the mass of the animal is proportional to the cube of its length.

If a mouse doubles in mass, by what factor would you expect the surface area to increase?

7. The graph shows distance versus time for a runner who had a delayed start, then sprinted hard and gradually tired. Show on the graph how fast a runner would have to run in order never to be caught by the delayed sprinter (draw on the graph and then say how this answers the question). Is a runner who runs at precisely this speed ever caught by the sprinter?



8. The value of a used car that has been owned for a time t is modeled as

$$\begin{cases} V(t) = V_0 & t = 0 \\ V(t) = (1 - \beta)V_0e^{-kt} & t > 0 \end{cases}$$

(a) What are the units of β and k and what are their interpretations?

(b) If the Kelly Blue book lists a Prius as worth \$27,000, \$18,000, and \$13,500 when new, two years old and four years old respectively, what is β ?