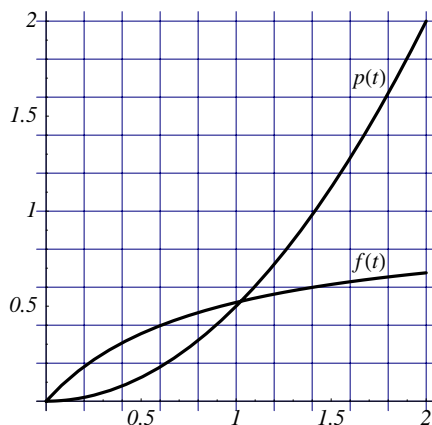
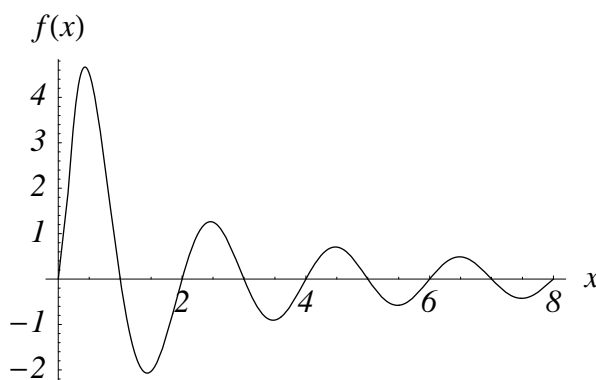


## Definite Integrals and the Fundamental Theorem of Calculus

1. Let  $p(t)$  be the rate of growth (in meters per year) of a particular pine tree. Let  $f(t)$  be the rate of growth (in meters per year) of a particular fir tree. The graphs of  $p(t)$  and  $f(t)$  are given below. Assume that the two trees were of the same height at  $t = 0$ .



- Express the change in height of the pine tree after six months as a definite integral.
  - Which tree is taller after 1 year?
  - Which tree is taller after 2 years?
  - At approximately what time(s) are the trees growing at the same rate?
  - At approximately what time(s) are the trees the same height?
2. Let  $f(x) = \frac{10\pi x \sin(\pi x)}{1 + (\pi x)^2}$ , as shown in the graph below.

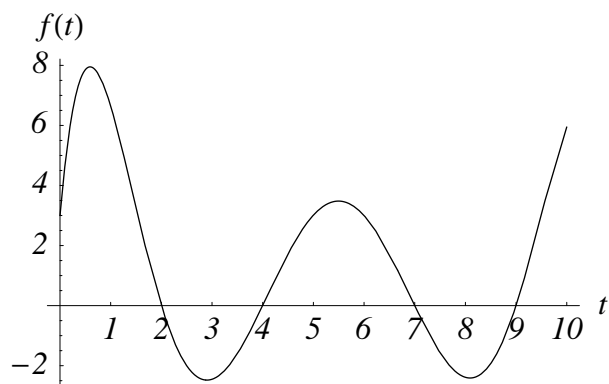


Put the following integrals in ascending order, from most negative to most positive.

- |                        |                        |
|------------------------|------------------------|
| (a) $\int_2^8 f(x) dx$ | (d) $\int_0^1 f(x) dx$ |
| (b) $\int_1^2 f(x) dx$ | (e) $\int_5^6 f(x) dx$ |
| (c) $\int_2^2 f(x) dx$ | (f) $\int_2^6 f(x) dx$ |

3. The graph of the function  $f$  is shown below. Define the “area thus far” function  $A$  on the domain  $[0, 10]$  by the formula

$$A(x) = \int_0^x f(t) dt.$$



- On what intervals is the area function  $A$  increasing?
- On what intervals is the area function  $A$  decreasing?
- At what values of  $x$  does  $A$  have a local maximum? local minimum?
- At what values of  $x$  does  $A$  have an absolute maximum? absolute minimum?
- On what intervals (approximately) is the area function  $A$  concave up?
- On what intervals (approximately) is the area function  $A$  concave down?