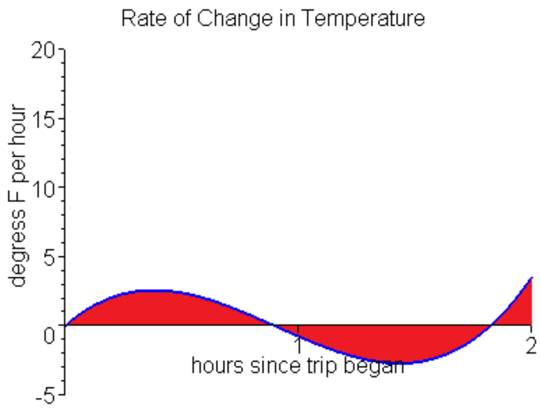
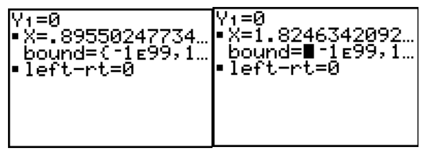
1. The rate of change in temperature in a museum during a junior high school field trip can be modeled by $T(h) = 9.07h^3 - 24.69h^2 + 14.87h - 0.03$ °F per hour *h* hours after the trip began.

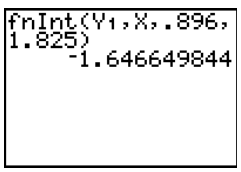


a. Find the <u>area</u> of the region that lies below the axis between the graph of *T* and the *h*-axis. Interpret the answer in a sentence.

Find the *h*-intercepts by solving *T(h)* = 0 →



$\int_{0.896}^{1.825} T(h)dh =$



$= -1.647$. The area is 1.647 °F.

From .896 to 1.825 hours into the field trip, the temperature in the museum decreased 1.647°F.

b. Find the total area trapped between the graph of *T* and the h-axis between *h* = 0 and *h* = 2. Include the mathematical notation for the total area in your work.

$\int_{0}^{0.896} T(h)dh - \int_{0.896}^{1.825} T(h)dh + \int_{1.825}^{2} T(h)dh = 1.483 - (-1.647) + .283 = 3.413$ °F

c. There are items in the museum that should not be exposed to temperatures greater than 73°F. IF the temperature at the start of the field trip was 71°F, did the temperature exceed 73°F during the two hour field trip?

No, the temperature increased to 72.483°F but then decreased to 70.836°F before increasing to 71.119°F at the end of the field trip.

d. Evaluate $\int_0^2 T(h)dh$. Interpret your answer in a sentence.

During the 2-hours after the field trip began, the temperature increased 0.12 °F

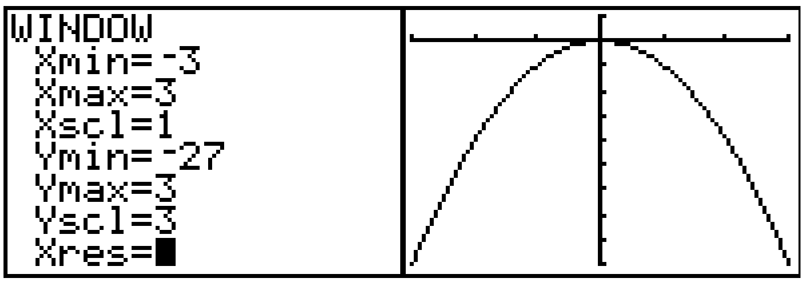
2 a. Find the accumulation function $F(x) = \int_0^x 3e^{2t}\,dt$

$$F(x) = \int_0^x 3e^{2t}\,dt = \left(\frac{3e^{2t}}{2}\right)\Bigg|_0^x = \frac{3e^{2x}}{2} - \frac{3e^{2(0)}}{2} = \frac{3e^{2x}}{2} - \frac{3}{2}$$

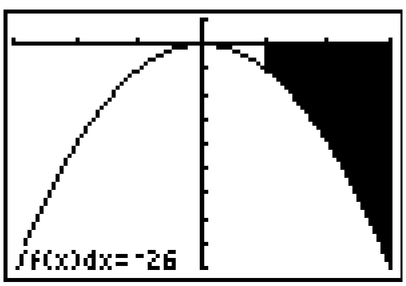
b. Use part a to find F(1)

$$F(1) = \frac{3e^{2(1)}}{2} - \frac{3}{2} \approx 9.584$$

3 a. Graph the function $f(x) = -3x^2$ from $x = -3$ to $x = 3$.



b. Find the area of the region between the graph of f and the x-axis from $x = 1$ to $x = 3$.



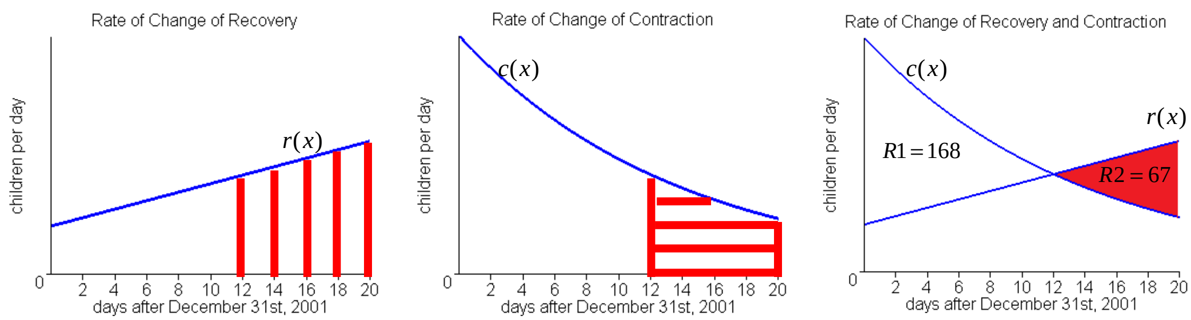
Area = $-\int_1^3 f(x)dx = 26$

c. Is the area in part b equal to $\int_1^3 f(x)dx$? Explain why or why not.

No, $\int_1^3 f(x)dx = -26$ and represents the accumulated change which is the negative of the area in this instance.

4. Winter is the cold season. The following graphs show the contraction and recovery rates for children getting a cold in a daycare center. The function c(x) is the rate in which the children contract the cold in children per day. The function r(x) is the rate in which the children recover from the cold in children per day. For both functions the input variable x represents the number of days after December 31st, 2001. (x=1 is January 1st, 2002, x=2 is January 2nd, 2002, etc.)

Assume the graphs intersect at x=12.



a. *Shade, with vertical lines*, the region on the appropriate graph that represents the **change in the number of children who recover** from the cold from January 12th, 2002 to January 20th, 2002.

b. *Shade with horizontal lines,* the region on the appropriate graph that represents the **change in the number of children who have contracted the cold** from January 12th, 2002 to January 20th, 2002.

c. What does the area between *c(x)* and *r(x)* represent in the context of this problem?
The change in the number of children that have colds.

d. *Shade solid* the region on the appropriate graph that represents the **change in the number of sick children** from January 12th, 2002 to January 20th, 2002.

e. Did the number of children who **contracted** the cold increase or decrease from January 12th, 2002 to January 20th, 2002? Give a mathematical reason for your answer.
The number of children who contracted the cold was increasing at a slower and slower rate, which means the number of children who contracted the cold INCREASED. We know this because the graph of *c(x)* is positive (above the axis) from 1/12 to 1/20.

f. Interpret R2 in the context of the problem.
From 1/12 to 1/20, the number of sick children decreased by 67 children. OR
From 1/12 to 1/20, the increase in the number of children recovering from colds was 67 children more that the increase in the number of children who contracted the cold.

g. Write a mathematical **equation** involving <u>one</u> integral for the change in the number of sick children from December 31, 2002 to January 20th, 2002.

$\int_{12}^{20} c(x) - r(x)dx = 101$ OR $\int_{12}^{20} r(x) - c(x)dx = -101$