1. Since the child won't "shrink", $h'(t) > 0 \,\forall\, t$. The definite integral $\displaystyle\int_0^{10} h'(t)\,\mathrm{d}t$ therefore represents the total growth, in inches, of the child in the first ten years.

2. If the rate of change is always positive or always negative, the integral represents the total change in the radius of the balloon, in centimeters, from $t = 1$second to $t = 2$ seconds.

3. If $v(t)$ changes sign, the integral represents the net distance traveled, in centimeters, from t_1 to t_2.
If $v(t)$ does not change sign, the integral represents the total distance traveled, in centimeters, from $t = 1$second to $t = 2$ seconds.

4. Since the sludge will never be "sucked out" of the river, $V(t) \geq 0 \,\forall\, t$ and thus the integral $\displaystyle\int_0^{60} V(t)\,\mathrm{d}t$ represents the total amount of sludge, in gallons, emptied into the river during the first hour. Note: Since $V(t)$ is measured in gallons per minute, the first hour must be 0 to 60.

5. (a) $C(x) = x^2 + x + D$ and since $C(2) = 50 \longrightarrow C(x) = x^2 + x + 44$
   (b) $C(50) = 2594 \therefore$ the cost of making 50 items is $\$2594$. (The cost of the 50th item would be $C'(50)$).
   (c) $\displaystyle\int_9^{100} C'(x)\,\mathrm{d}x = 10010 \therefore$ the cost of the 9th through the 100th item is $10010.

6. Net Distance

$$\int_1^6 (t^2 - 2t - 8)\,\mathrm{d}t = -\frac{10}{3} \therefore \text{ the net distance traveled is } -\frac{10}{3} \text{ units.}$$

Total Distance

$$\int_1^6 |t^2 - 2t - 8|\,\mathrm{d}t = -\int_1^4 (t^2 - 2t - 8)\,\mathrm{d}t + \int_4^6 (t^2 - 2t - 8)\,\mathrm{d}t = \frac{98}{3} \therefore \text{ the total distance traveled is } -\frac{98}{3} \text{ units.}$$

7. Net Distance

$$\int_0^5 v(t)\,\mathrm{d}t = 1.540 \therefore \text{ the net distance traveled is } 1.540 \text{ units.}$$

Total Distance

$$\int_0^{65} |v(t)|\,\mathrm{d}t = 1.540 \therefore \text{ the total distance traveled is } 1.540 \text{ units.}$$

Net and total are the same because $v(t) > 0 \,\forall\, t$.

8. (a) Since $v(t) = \sin t + e^{-t} \longrightarrow s(t) = -\cos t - e^{-t} + C$.
Since $x = 0$ when $t = 0$, $C = 2 \longrightarrow s(t) = -\cos t - e^{-t} + 2$

(b) $v(t) = 0$ when $t = 3.183$

(c) $\dfrac{1}{5}\displaystyle\int_0^5 \left(-\cos t - e^{-t} + 2\right) \mathrm{d}t = 1.993$

(d) $\displaystyle\int_0^5 |v(t)| \,\mathrm{d}t = 4.206$

9. Since the population in increasing for t, the total population increase will be $\displaystyle\int_4^{10} (200 + 50t) \,\mathrm{d}t = 3300$.

To know the total population, we would need to know how many were present at $t = 4$!

10. (a) Since the rate of consumption is always positive (assuming no one is putting electricity back into the system),
$\displaystyle\int_0^{24} R(t) \,\mathrm{d}t \approx 37773.057 \therefore$ 37773.057 kw .

(b) $\dfrac{1}{8}\displaystyle\int_0^8 R(t) \,\mathrm{d}t \approx 2200.318 \therefore$ 2200.318 kw/h

(c) Maximize the rate of consumption by setting $R'(t) = 0$. $R'(t) = 0$ when $t \approx 4.886 \longrightarrow R(4.886) \approx 2285.322 \therefore$ max rate of consumption is 2285.322 kw/h .

11. Net Distance

$$\int_0^3 \left(e^t - 2\right) \mathrm{d}t \approx 13.086 \therefore \text{ the net distance is 13.086 units.}$$

Total Distance

$$\int_0^3 \left|e^t - 2\right| \mathrm{d}t \approx 13.858 \therefore \text{ the total distance is 13.858 units.}$$

12. Net Distance

$$\int_0^3 \left(t^3 - 3t^2 + 2t\right) \mathrm{d}t = 2.250 \therefore \text{ the net distance is 2.250 units.}$$

Total Distance

$$\int_0^3 \left|t^3 - 3t^2 + 2t\right| \mathrm{d}t = 2.750 \therefore \text{ the total distance is 2.750 units.}$$

13. Net and total will be the same because $\sin t > 0 \,\forall\, t$ in the interval.

$$\int_0^{\pi/2} \sin t \,\mathrm{d}t = 1 \therefore \text{ the net and total distance is 1 unit.}$$

14. Net and total will be the same because $v(t) > 0 \,\forall\, t$ in the interval.

$$\int_0^5 |x - 3| \,\mathrm{d}t = \frac{13}{2} \therefore \text{ the net and total distance is } \frac{13}{2} \text{ units.}$$

15. $\displaystyle\int_0^{12} 40\,(1.002)^t \,\mathrm{d}t \approx 485.801 \therefore$ \$485.80

16. Total change in temperature $= \int_0^{10} r(t)\,\mathrm{d}t \approx -44.248 \therefore$ the new temperature $= 90 - 44.248 = 45.752 \therefore$ new temperature is about 46 degrees.

17. (a) $\int_0^2 R(t)\,\mathrm{d}t$ Absolute value not needed because $R(t) > 0\,\forall\, t \in (0, 2)$.

    (b) $\int_0^5 R(t)\,\mathrm{d}t \approx 8.5$ Count squares–2 squares is one gallon.

    (c) $\int_0^{10} R(t)\,\mathrm{d}t \approx 12.5$