

$$503. f'(x) = \frac{2}{x^2} - \frac{x^2}{2}, f(1) = 0$$

For the following exercises, find two possible functions f given the second- or third-order derivatives.

$$504. f''(x) = x^2 + 2$$

$$505. f''(x) = e^{-x}$$

$$506. f''(x) = 1 + x$$

$$507. f'''(x) = \cos x$$

$$508. f'''(x) = 8e^{-2x} - \sin x$$

509. A car is being driven at a rate of 40 mph when the brakes are applied. The car decelerates at a constant rate of 10 ft/sec². How long before the car stops?

510. In the preceding problem, calculate how far the car travels in the time it takes to stop.

511. You are merging onto the freeway, accelerating at a constant rate of 12 ft/sec². How long does it take you to reach merging speed at 60 mph?

512. Based on the previous problem, how far does the car travel to reach merging speed?

513. A car company wants to ensure its newest model can stop in 8 sec when traveling at 75 mph. If we assume constant deceleration, find the value of deceleration that accomplishes this.

514. A car company wants to ensure its newest model can stop in less than 450 ft when traveling at 60 mph. If we assume constant deceleration, find the value of deceleration that accomplishes this.

For the following exercises, find the antiderivative of the function, assuming $F(0) = 0$.

$$515. \text{ [T] } f(x) = x^2 + 2$$

$$516. \text{ [T] } f(x) = 4x - \sqrt{x}$$

$$517. \text{ [T] } f(x) = \sin x + 2x$$

$$518. \text{ [T] } f(x) = e^x$$

$$519. \text{ [T] } f(x) = \frac{1}{(x+1)^2}$$

$$520. \text{ [T] } f(x) = e^{-2x} + 3x^2$$

For the following exercises, determine whether the statement is true or false. Either prove it is true or find a counterexample if it is false.

521. If $f(x)$ is the antiderivative of $v(x)$, then $2f(x)$ is the antiderivative of $2v(x)$.

522. If $f(x)$ is the antiderivative of $v(x)$, then $f(2x)$ is the antiderivative of $v(2x)$.

523. If $f(x)$ is the antiderivative of $v(x)$, then $f(x) + 1$ is the antiderivative of $v(x) + 1$.

524. If $f(x)$ is the antiderivative of $v(x)$, then $(f(x))^2$ is the antiderivative of $(v(x))^2$.