Related Rates 1 Circuit Name: Jr Chris Block: Seat:

Directions: Begin in cell #1. Search for your answer. Continue in this manner until you complete the circuit. Additional paper may be necessary! No technology is needed!

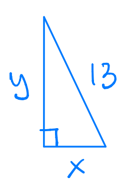
Answer: $-\frac{14}{5} ft/sec$

#__1__: A spherical balloon is deflated so that its radius decreases at a rate of 4 cm/sec. At what rate is the volume of the balloon changing when the radius is 3 cm?

1. Given $\frac{dr}{dt} = -4$ cm/sec
2. Find $\left.\frac{dV}{dt}\right|_{r=3cm} =$ cm^3/sec
3. $V = \frac{4}{3}\pi r^3$
4. $\frac{dV}{dt} = 4\pi r^2 \left(\frac{dr}{dt}\right)$
5. $\left.\frac{dV}{dt}\right|_{r=3} = 4\pi(3)^2(-4) = -144\pi$ cm^3/sec
6. "When the radius is 3, the volume is decreasing at a rate of 144π cubic cm per second"

Answer: $216\pi cm^2/min$

#__3__: A 13 ft ladder is leaning against a wall and sliding towards the floor. The top of the ladder is sliding down the wall at a rate of 7 ft/sec. How fast is the base of the ladder sliding away from the wall when the base of the ladder is 12 ft from the wall?



1. given $\frac{dy}{dt} = -7$ ft/sec
2. Find $\left.\frac{dx}{dt}\right|_{x=12,\ y=5} = ?$ ft/sec
3. $y^2 + x^2 = 13^2$
4. $2y\frac{dy}{dt} + 2x\frac{dx}{dt} = 0$
5. $2(5)(-7) + 2(12)\left(\frac{dx}{dt}\right) = 0$

   $\frac{dx}{dt} = \frac{(2)(5)(+7)}{(2)(12)} = \frac{35}{12}$ ft/sec
6. "When the base of the ladder is 12' from the wall, the rate it is sliding away from the wall is increasing by 35/12 feet per second

Answer: $-144\pi cm^3/sec$

#__2__: Water leaking onto a floor forms a circular pool. The radius of the pool increases at a rate of 9 cm/min. How fast is the area of the pool increasing when the radius is 12 cm?

1. Given $\frac{dr}{dt} = 9$ cm/min

2. Find $\left.\frac{dA}{dt}\right|_{r=12cm} = ?$ cm^2/min

3. $A = \pi r^2$

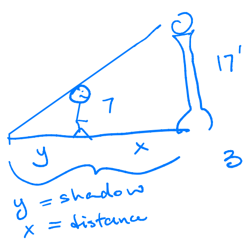
4. $\frac{dA}{dt} = 2\pi r \left(\frac{dr}{dt}\right)$

5. $\left.\frac{dA}{dt}\right|_{r=12} = 2\pi(12)(9) = 216\pi$ cm^2/min

When the radius of the pool is 12 cm the Area is increasing at a rate of 216π square cm per minute

Answer: $\frac{35}{12} ft/sec$

#__4__: A 7 ft tall person is walking towards a 17 ft tall lamppost at a rate of 4 ft/sec. Assume the scenario can be modeled with right triangles. At what rate is the length of the person's shadow changing when the person is 12 ft from the lamppost?



1. given $\frac{dx}{dt} = -4$ ft/sec

2. Find $\left.\frac{dy}{dt}\right|_{x=12} = ?$ ft/sec

3. $\frac{y}{x+y} = \frac{7}{17}$

$17y = 7x + 7y$

$y = \frac{7x}{10}$

4. $\frac{dy}{dt} = \frac{7}{10}\frac{dx}{dt}$

5. $\left.\frac{dy}{dt}\right|_{x=12} = \frac{7}{10}(-4) = \frac{-14}{5}$ ft/sec

6 "When the person is 12' from the lamppost the shadow is shrinking at a rate of $\frac{14}{5}$ feet per second"