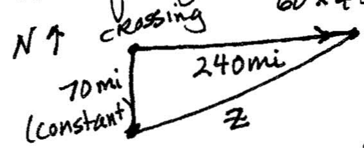
Related Rates – Answers

① Here's what you got. ↗ cause 4 sec.
$60 \times 4 = 240$

(A)



Find z $(240)^2 + (70)^2 = z^2 \Rightarrow z = 250$

$57600 + 4900 =$
$62500 = z^2$

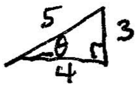
$x^2 + 70^2 = z^2$ take der. $2x\frac{dx}{dt} + 0 = 2z\frac{dz}{dt}$ ↙ looking for this

$x = 240$, $\frac{dx}{dt} = 60$ $\quad z = 250$, $\frac{dz}{dt} = ?$ $\quad \frac{(240)(60)}{250} = \frac{dz}{dt} = 57.6\ m/s$

② Know $\frac{d\theta}{dt} = 3$ rad/min need to find $\frac{dx}{dt}$. Stuff given means we should

(E) work with $\boxed{\sin\theta = \frac{x}{5}}$. Take der to get $\frac{dx}{dt}$ to show up.

when $x = 3$
base side $= 4$



$\cos\theta \cdot \frac{d\theta}{dt} = \frac{1}{5}\frac{dx}{dt} \Rightarrow \frac{4}{5}(3) = \frac{1}{5}\frac{dx}{dt} \Rightarrow 12 = \frac{dx}{dt}$

$\cos\theta = \frac{4}{5}$

③ Know $\frac{dr}{dt} = -\frac{1}{10}$. Need to find $\frac{dA}{dt}$ using circumference.

(B) (make sure you use (−) because it's told radius is dec.)

$A = \pi r^2$ so

$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$ since $2\pi r = C$

$\frac{dA}{dt} = -.1C$ ⟵ $\frac{dA}{dt} = C\frac{dr}{dt}$ ⟵ and $\frac{dr}{dt} = \frac{-1}{10}$

④ Told $\frac{db}{dt} = 3$ in/min and $\frac{dh}{dt} = -3$ in/min (neg because height is dec)

(D) Area formula of △ $A = \frac{1}{2}bh$ $\quad \frac{dA}{dt} = \frac{1}{2}\left(b \cdot \frac{dh}{dt} + h \cdot \frac{db}{dt}\right)$

by checking out c and d first
a, b, e eliminate themselves right away.

this ↗ will tell us if Area is inc or dec. b & h are pos. #'s

if $b < h$ ($3 < 4$) $\Rightarrow \frac{dA}{dt} = \frac{1}{2}\left(3(-3) + 4(3)\right) = +$ so Area inc

'C' is false

if $b > h$ ($4 > 3$) $\frac{dA}{dt} = \frac{1}{2}\left(4(-3) + 3(3)\right) = -$ so Area dec.

⑤ Know $\frac{dR}{dt} = .2$ m/sec $\Rightarrow \frac{dr}{dt} = \frac{1}{5}$ m/sec.

(C) Looking for $\frac{dA}{dt}$ when C is 20π m.

This is similar to #3.

$A = \pi r^2$ ⟷ $2\pi r = C = 20\pi$

$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$

$\frac{dA}{dt} = 20\pi \cdot \frac{1}{5} = 4\pi\ m^2/sec$