Use an appropriate linear approximation to estimate $\tan^{-1} 0.97$.

$f(x) = \tan^{-1} x$, $a = 1$

$f(x) \approx f(a) + f'(a)(x-a)$ FOR $x \approx a$

$= \tan^{-1} 1 + \frac{1}{1+1^2}(x-1)$ FOR $x \approx 1$

$= \frac{\pi}{4} + \frac{1}{2}(x-1)$

$\tan^{-1} 0.97 \approx \frac{\pi}{4} + \frac{1}{2}(0.97-1) = \boxed{\frac{\pi}{4} + \frac{1}{2}(-0.03)} = \boxed{\frac{\pi}{4} - 0.015}$

A man walks along a straight path. A searchlight is located on the ground 15 feet from the path, and is kept **SCORE: _____ / 10 PTS**
focused on the man. When the man is 20 feet from the point on the path closest to the searchlight, the light is turning at $3°$ per second.
How quickly is the man walking at that moment ?
You must state/show clearly what each variable you use represents.
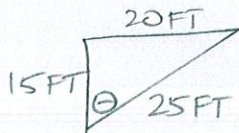**You must show the units during the intermediate steps of your work, and you must state the units for the final answer.**
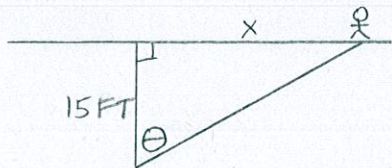
$$\left.\frac{d\theta}{dt}\right|_{x=20\,FT} = 3°/SEC = \frac{\pi}{60}\ RADIANS/SEC \ OR \ \frac{\pi}{60}/SEC$$

$$WANT \ \left.\frac{dx}{dt}\right|_{x=20\,FT}$$

$$② \quad \frac{X}{15\,FT} = \tan\theta$$

$$① \quad \frac{1}{15\,FT}\frac{dx}{dt} = \sec^2\theta\,\frac{d\theta}{dt} \quad ①$$

$$⓪ \quad X=20\,FT$$

$$\frac{1}{15\,FT}\frac{dx}{dt} = \left(\frac{25\,FT}{15\,FT}\right)^2 \frac{\pi}{60}/SEC$$

$$\frac{dx}{dt} = (15\,FT)\left(\frac{5}{3}\right)^2 \frac{\pi}{60}/SEC$$

$$= \frac{25\pi}{36}\ FT/SEC$$

$$\text{THE MAN IS WALKING AT } \frac{25\pi}{36}\ \text{FEET PER SECOND}$$

Find the values of Δy and dy if $y = \frac{1}{\sqrt{x}}$ and x changes from 1 to 4 .

$$\Delta y = y(4) - y(1) = \frac{1}{\sqrt{4}} - \frac{1}{\sqrt{1}} = \boxed{\frac{1}{2} - 1} = \boxed{-\frac{1}{2}}$$

$$dy = y'(1)\,dx = \boxed{\frac{-1}{2}(1)^{-\frac{3}{2}}(4-1)} = \boxed{-\frac{3}{2}}$$

A 6 foot tall woman is standing 12 feet from a pole. A spot light is being lowered from the top of the pole. **SCORE:** _____ / 10 PTS
At the moment when the light is 15 feet from the ground, the light is moving 2 feet per second down the pole.
How quickly is the length of the woman's shadow changing at that moment ?
<u>You must state/show clearly what each variable you use represents.</u>
<u>You do NOT need to show the units during the intermediate steps of your work, but you must state the units for the final answer,</u>
<u>and whether the shadow is getting longer or shorter.</u>
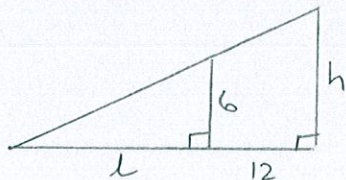
$$\frac{dh}{dt}\bigg|_{h=15\ FT} = -2\ FT/SEC$$

$$WANT\ \frac{dl}{dt}\bigg|_{h=15\ FT}$$

$$\frac{l}{6} = \frac{l+12}{h} \longrightarrow @\ h=15\ FT \quad \frac{l}{6} = \frac{l+12}{15}$$

② $lh = 6l+72$ TALK TO ME $15l = 6l+72$
IF YOU WROTE $9l = 72$
THIS EQUATION $l=8$
IN ANOTHER WAY

① $\frac{dl}{dt}h + l\frac{dh}{dt} = 6\frac{dl}{dt}$ ½

$\frac{dl}{dt}(15) + 8(-2) = 6\frac{dl}{dt}$
① 1½ 1½

$9\frac{dl}{dt} = 16$

① $\frac{dl}{dt} = \frac{16}{9}$

½

THE SHADOW IS GETTING LONGER
BY $\frac{16}{9}$ FEET PER SECOND
½ ½