

FILL IN THE BLANKS: You wish to estimate $f(2.1)$ given that $f(2) = 3$ and $f'(2) = -5$.

SCORE: ____ / 5 PTS

Your answers may use decimals.

The correct answer to one of these questions is "UNKNOWN".

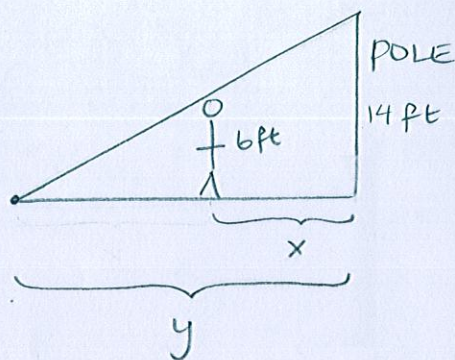
$$\Delta x = \underline{0.1} \text{ ①} \quad \Delta y = \underline{\text{UNKNOWN}} \text{ ①} \quad dx = \underline{0.1} \text{ ①} \quad dy = \underline{-0.5} \text{ ①} \quad f(2.1) \approx \underline{2.5} \text{ ①}$$

A lantern is mounted at the top of a 14 foot tall pole. A 6 foot tall woman walks towards the pole with a speed of 4 feet per second along a straight path. How fast is the tip of her shadow moving when she is 20 feet from the pole?

SCORE: ____ / 10 PTS

You must state clearly what each variable you use represents.

You must state the units for the final answer. You do NOT need to show the units during the intermediate steps of your work.



① x = DISTANCE FROM WOMAN TO POLE

① y = DISTANCE FROM TIP OF SHADOW TO POLE

$$\frac{dx}{dt} = -4 \text{ ft/sec}$$

WANT $\frac{dy}{dt}$ WHEN $x = 20 \text{ ft}$

$$\frac{y}{14} = \frac{y-x}{6} \text{ ③}$$

$$6y = 14y - 14x$$

$$y = \frac{7}{4}x$$

$$\frac{dy}{dt} = \frac{7}{4} \frac{dx}{dt} \text{ ②}$$

$$= \frac{7}{4} \cdot 4 \text{ ①}$$

$$= \underline{-7 \text{ ft/sec}} \text{ ① ①}$$

Use an appropriate linear approximation to estimate $\sqrt[4]{80.55}$.

SCORE: ____ / 6 PTS

① $f(x) = x^{\frac{1}{4}}$ ① $f'(x) = \frac{1}{4} x^{-\frac{3}{4}}$ USE $L(x)$ AT $x = 81$

$$L(x) = f(81) + f'(81)(x - 81)$$

$$= 3 + \frac{1}{108}(x - 81)$$

$$\sqrt[4]{80.55} = f(80.55) \approx L(80.55) = \overset{\textcircled{1}}{3} + \overset{\textcircled{1}}{\frac{1}{108}} \overset{\textcircled{1}}{(-0.45)}$$

$$= 3 + \frac{1}{108} \left(-\frac{9}{20} \right) = \frac{2}{12} \frac{239}{240} \textcircled{1} \text{ MUST BE FRACTION}$$

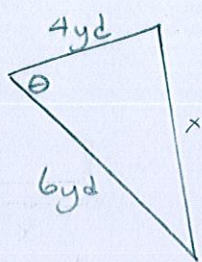
Two sides of a triangle have lengths 6 yards and 4 yards. The angle between them is increasing at a rate of 3° per minute. How fast is the length of the third side increasing when the angle between the sides of fixed length is 56° ?

SCORE: ____ / 9 PTS

Your answers may use decimals.

You must state clearly what each variable you use represents.

You must state the units for the final answer. You do NOT need to show the units during the intermediate steps of your work.



① θ = ANGLE BETWEEN FIXED LENGTH SIDES

② x = LENGTH OF THIRD SIDE

$$\frac{d\theta}{dt} = \frac{\pi}{60} \frac{\text{RADIANS}}{\text{MINUTE}}$$

WANT $\frac{dx}{dt}$ WHEN $\theta = \frac{14\pi}{45}$ RADIANS

$$x^2 = 4^2 + 6^2 - 2(4)(6)\cos\theta$$

② $x^2 = 52 - 48\cos\theta$ → WHEN $\theta = \frac{14\pi}{45}$ RADIANS,

② $2x \frac{dx}{dt} = 48 \sin\theta \frac{d\theta}{dt}$

$$x = \sqrt{52 - 48\cos\frac{14\pi}{45}}$$

$$x \approx 5.016$$

③ $5.016 \frac{dx}{dt} = 24 \left(\sin\frac{14\pi}{45} \right) \left(\frac{\pi}{60} \right) \textcircled{1}$

$$\frac{dx}{dt} \approx \underset{\textcircled{2}}{0.2077} \underset{\textcircled{2}}{\frac{\text{YARDS}}{\text{MINUTE}}}$$

MUST BE IN RADIANS