**Approximation of change of $y$ as a result of change of $x$**

- When $x_1 = 2, y_1 = 14$. If $\Delta x = 0.1$, we can approximate

$$\begin{aligned}\Delta y &\approx f'(x_1).\Delta x\\ &= f'(2).0.1\\ &= 2(2)\cdot 0.1 = 0.4\end{aligned}$$

- What is the real $\Delta y$?

$$y_2 = f(2.1) = 10 + (2.1)^2 = 14.41$$
$$\Delta y = y_2 - y_1 =$$

- We underestimate the real change of $y$.
- What if $\Delta x = -0.2$? Approximate the change of $y$.

a). $y' = 10 + \sqrt{x}$
$y' = x^{\frac{1}{2}}$
$y' = \frac{1}{2}\left(\frac{1}{\sqrt{x}}\right)$

**HW** Given $y = 10 + \sqrt{x}$,

a) Find the derivative $f'(x)$.
b) Fill in the table

| Point | X | Y | $f'(x)$ |
|---|---|---|---|
| | 0 | 10 | |
| A | 1 | 11 | 0.5 |
| B | 2 | 11.414 | 0.3536 |
| C | 3 | 11.732 | 0.2887 |

not exact
Formula: $\Delta Y = f'(x_1) \times \Delta x$

c) Does the slope increase as $x$ increases? No
d) Approximate the change in Y when $\Delta x = 0.2$ at $x_1 = 3$. Is the approximation under- or over-estimate?

Find $\Delta Y$ known $\Delta x = 0.2$ $x = 3$
$= f'(3) \times 0.2$
$= 0.2887 \times 0.2 = 0.05774$

Note: If the function $f(x)$ is linear, the approximation is exact.

$\Delta Y$
$Y_2 = f(3.2) = 10 + \sqrt{3.2} = 11.7889$

$m = \dfrac{Y_2 - Y_1}{X_2 - X_1} = 11.7889 - 11.732 = 0.0569$