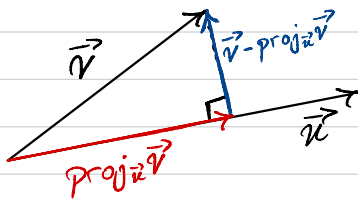


# Math 102 · Lab 4 · Projections

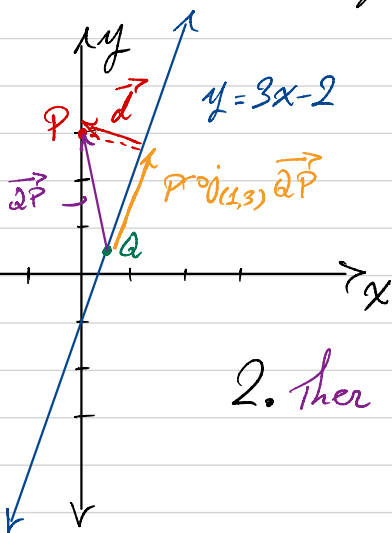
Recall:



$$\text{proj}_{\vec{u}} \vec{v} = \frac{\vec{v} \cdot \vec{u}}{\|\vec{u}\|^2} \vec{u}$$

Example: What is the (shortest) distance from the point  $P=(0,6)$  to the line  $y=3x-2$ ?

Solution:



1. Let us find a point  $Q$  on the line, say  $Q=(1,1)$

2. Then  $\vec{dP} = P - Q = (0,6) - (1,1) = (-1,5)$

$$\vec{d} = \vec{dP} - \text{proj}_{(1,3)} \vec{dP}$$

3. A vector tangent to the line is  $(1,3)$ . We now want to find  $\text{proj}_{(1,3)} \vec{dP} = (\frac{7}{5}, \frac{21}{5})$

4. Distance  $= \|\vec{d}\| = \|(-\frac{12}{5}, \frac{4}{5})\| = \frac{4\sqrt{10}}{5}$