Q=100-5P
demand curve

slope

$$\Delta y = y_2 - y_1$$

$$\Delta x = x_2 - x_1$$

$$slope = \frac{\Delta y}{\Delta x}$$

$$slope = \frac{y_2 - y_1}{x_2 - x_1}$$

Q=100-5P
write P as function of Q:

$$Q + \mathbf{5P} = 100 - 5P + \mathbf{5P}$$

Q+5P=100

$$Q - \mathbf{Q} + 5P = 100 - \mathbf{Q}$$

5P=100-Q
P=20-Q/5=
20-.2Q

total revenue
P=20-.2Q
TR=PQ=(20-.2Q)Q

$$TR = 20Q - .2Q^2$$

$$lookforslopefory = x^2$$

line that crosses curve at two points:
secant line
move the two points very close together
almost the same as one point

line that touches curve at one point:
tangent line

$$y = x^2$$

look for general rules to find slope
call first point (x,y)

$$callsecondpoint (x_2, y_2)$$

$$slope = \frac{y_2 - y}{x_2 - x}$$

$$y_2 = x_2^2$$

$$slope = \frac{x_2^2 - x^2}{x_2 - x}$$

$$slope = (x_2^2 - x^2)/(x_2 - x)$$

$$x_2 - x =$$

$$\Delta x$$

$$x_2 =$$

$$x + \Delta x$$

substitute into formula for slope:

$$slope = \frac{(x + \Delta x)^2 - x^2}{\Delta x}$$

$$slope = \frac{(x + \Delta x)^2 - x^2}{\Delta x}$$

$$multiplyout (x + \Delta x)^2 :$$

$$slope = \frac{\mathbf{x^2} + 2x\Delta x + \Delta x^2 - \mathbf{x^2}}{\Delta x}$$

$$canceloutx^2 - x^2 :$$

$$slope = \frac{2x\Delta x + \Delta x^2}{\Delta x}$$

$$factorout \Delta x :$$

$$slope = \frac{(2x + \Delta x)\mathbf{\Delta x}}{\mathbf{\Delta x}}$$

$$cancelout \Delta x/\Delta x :$$

$$slope = 2x + \Delta x$$

$$as \Delta x approaches zero :$$

slope approaches 2x

slope: called derivative

$$notation : derivative = \frac{dy}{dx}$$

rules for derivatives
y=17
horizontal line
slope=0

let c represent any constant number

$$rule : y = c, \frac{dy}{dx} = 0$$

y=17x
look at slope between two points on line:
x=0, y
=0
x=1, y
=17
(0,0) and (1,17)
slope=17

$$rule : y = cx, deriv. = \frac{dy}{dx} = c$$

$$rule : y = x^2, deriv. = 2x$$

slope is different for different values of x
x=10, y=
100,
slope=
20

$$rule : y = cx^2, deriv. = 2cx$$

rule:
y=f(x)+g(x)

$$then \frac{dy}{dx} = \frac{df}{dx} + \frac{dg}{dx}$$

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$$y = x^2, dy/dx = 2x$$
$$y = x^3, dy/dx = 3x^2$$
$$y = x^4,$$
$$dy/dx = 4x^3$$
$$y = x^5,$$
$$dy/dx = 5x^4$$
$$y = x^n,$$
$$dy/dx = nx^{n-1}$$

general rule:

$$y = cx^n$$
$$dy/dx = ncx^{n-1}$$

Total Revenue Maximization

$$TR = 20Q - .2Q^2$$
$$find \frac{dTR}{dQ}$$

derivative of 20Q:
20

$$derivative of - .2Q^2 :$$

-.4Q

$$\frac{dTR}{dQ} = 20 - .4Q$$

$$\frac{dTR}{dQ} = 20 - .4Q$$

set derivative equal to...
zero
20-.4Q=0
20=.4Q
20/.4=Q
Q=50

$$general : P = P_0 - \frac{P_0}{Q_0}Q$$

$$TR = P_0Q - \frac{P_0}{Q_0}Q^2$$

$$find \frac{dTR}{dQ}$$

$$TR = P_0Q - \frac{P_0}{Q_0}Q^2$$

$$derivative of P_0Q :$$

$$P_0$$

$$derivative of - \frac{P_0}{Q_0}Q^2 :$$

$$-2\frac{P_0}{Q_0}Q$$

$$\frac{dTR}{dQ} = P_0 - 2\frac{P_0}{Q_0}Q$$

$$0 = P_0 - 2\frac{P_0}{Q_0}Q$$

$$2\frac{P_0}{Q_0}Q = P_0$$

$$2\frac{\mathbf{P_0}}{Q_0}Q = \mathbf{P_0}$$

$$2\frac{\mathbf{P_0}}{Q_0}Q = \mathbf{P_0}$$

$$\frac{2}{Q_0}Q = 1$$

$$Q = \frac{Q_0}{2}$$