4.4
Notes

MODELING WITH FUNCTIONS

Objectives: 1) Model real world scenarios with functions.

SUGGESTED STEPS:

1. Picture and question
2. Define variable(s)
3. Label picture
4. Equation

GEOMETRY REVIEW!

NOTATION:

Express ___f___ in terms of ___x___. **f(x) = …**

Examples: Express area in terms of width. A(w) = …

perimeter side. P(s) = …

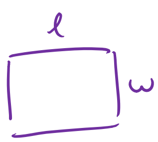
cost units produced. c(u) = …

profit number sold. p(n) = …

EXAMPLE PROBLEMS:

*No two problems are exactly alike, but you can find similarities and problem solve.

1) The perimeter of a rectangle is 50 ft. Express its area as a function of the length of a side.



$P = 2l + 2w$

$2l + 2w = 50$

$2w = -2l + 50$

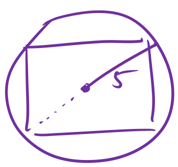
$w = -l + 25$

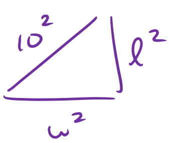
$A = lw$

$A(l) = l \cdot (-l + 25)$

$\boxed{A(l) = -l^2 + 25}$

2) A rectangle is inscribed in a circle with radius 5. Express the perimeter as a function of the length.





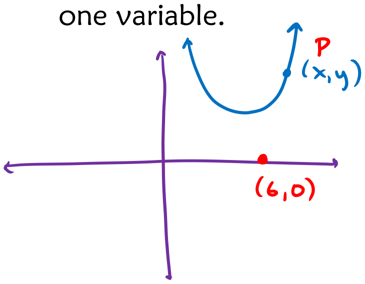
$P = 2l + 2w$

$100 = l^2 + w^2$

$w = \sqrt{100 - l^2}$

$\boxed{P(l) = 2l + 2\sqrt{100 - l^2}}$

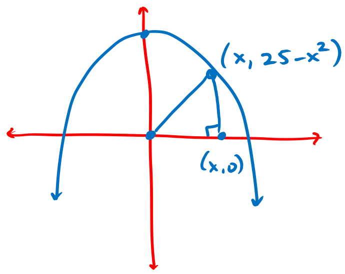
3) Let p(x,y) be a point on: $y = x^2 - 4x + 9$. Express the distance from P to the point (6,0) as a function of one variable.



$D = \sqrt{(x-6)^2 + (y-0)^2}$

$\boxed{D(x) = \sqrt{(x-6)^2 + (x^2 - 4x + 9)^2}}$

4) A right triangle has one vertex on $y = 25 - x^2$, one at the origin, and one at (x,0). Express the area of the triangle as a function of one variable.



$A = \frac{1}{2}bh$

$A(x) = \frac{1}{2}x(25-x^2)$

$\boxed{A(x) = \frac{25}{2}x - \frac{1}{2}x^3}$

5) A piece of wire x in. long is bent into a circle. Express the area in terms of x.

$C = 2\pi r$

$x = 2\pi r$

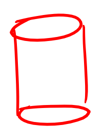
$r = \frac{x}{2\pi}$

$A(x) = \pi r^2$

$A(x) = \pi\left(\frac{x}{2\pi}\right)^2 = \pi\frac{x^2}{4\pi^2}$

$\boxed{A(x) = \frac{x^2}{4\pi}}$

6) A right circular cylinder has a volume of 10 cubic cm. Find the surface area S as a function of the radius of the base.



$V = \pi r^2 h$

$\pi r^2 h = 10 \rightarrow h = \frac{10}{\pi r^2}$

$S(r) = 2\pi r^2 + 2\pi r\underline{h}$
replace h

$S(r) = 2\pi r^2 + 2\pi r\left(\frac{10}{\pi r^2}\right)$

$\boxed{S(r) = 2\pi r^2 + \frac{20}{r}}$

7) Two numbers sum to be 100. Express the product P in terms of a single number.

$x + y = 100$ $y = 100 - x$

$P(x) = x\underline{y}$ replace y

$P(x) = x(100 - x)$

$\boxed{P(x) = 100x - x^2}$

8) *Revenue* = (price per unit)•(# of units sold)   R = p•x
Price is often a function of the number of units produced (demand curve):   p = m•x + b
Suppose the price (demand) curve is: p = –0.5x + 6. Express the revenue as a function of x

$R(x) = p \cdot x$
replace p

$R(x) = (-.5x + 6)x$

$\boxed{R(x) = -.5x^2 + 6x}$