Section 1-4: Day 2

Building Functions from Functions

- Students will be able to combine functions algebraically
- Students will be able to find and use composites of functions
- Students will be able to use relations and implicitly defined functions

Decomposing Functions

For each function h, find functions f and g such that h(x) = f(g(x)).

$h(x) = (\underbrace{x + 1}_{x})^2 - 3(\underbrace{x + 1}_{x}) + 4.$

$g(x) = x+1$

$f(x) = x^2 - 3x + 4$

$h(x) = \sqrt{x^3 + 1}$

$g(x) = x^3$

$f(x) = \sqrt{x+1}$

or

$g(x) = x^3 + 1$

$f(x) = \sqrt{x}$

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Find f(x) and g(x) so that the function can be described as
$y = f(g(x))$

$$y = |\,3x - 2\,|$$

$g(x) = 3x - 2$

$f(x) = |x|$

Modeling with Function Composition

In the medical procedure known as angioplasty, doctors insert a catheter into a heart vein (through a large peripheral vein) and inflate a small spherical balloon on the tip of a catheter. Suppose the balloon is inflated at a constant rate of 44 cubic millimeters per second.

Find the volume after *t* seconds. $\boxed{V = 44t}$

When the volume is V, what is the radius *r* ? $V_{SPHERE} = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi r^3$

Write an equation that gives the radius *r* as a function of the time. What is the radius after 5 seconds.

$\frac{3}{4} \cdot \frac{V}{\pi} = r^3$

$\sqrt[3]{\frac{3V}{4\pi}} = r$

$\sqrt[3]{\frac{3(44t)}{4\pi}} = r$

$\sqrt[3]{\frac{33t}{\pi}} = r$ 5

A high-altitude spherical weather balloon expands as it rises due to the drop in atmospheric pressure. Suppose that the radius increases at the rate of 0.03 inch per second and that r = 48 inches at the time t = 0. Determine an equation that models the volume V of the balloon at time t and find the volume when t = 300 seconds.

Verifying Pairs in a Relation

Determine which of the ordered pairs (2, -5), (1, 3), and (2, 1) are in the relation defined by $x^2y + y^2 = 5$. Is the relation a function?

Relation - set of ordered pairs (x, y) of real #'s

$2^2(-5) + (-5)^2 = 5$
$4(-5) + 25 =$
$-20 + 25 =$
$5 = 5$

$1^2(3) + 3^2 = 5$
$3 + 9 =$
$12 \neq 5$

$2^2(1) + 1^2 = 5$
$4 + 1 = 5$
$5 = 5$

(2, -5) and (2, 1) are in the relation

$2 <^{-5}_{1}$ not a function

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Which of the following ordered pairs (1, 1), (4, -2) and (3, -1) are in the relation given by $3x + 4y = 5$?

$(1,1)$ $3(1)+4(1)=5$

$3+4=5$

$7\neq 5$

$(4,-2)$ $3(4)+4(-2)=5$

$12-8=5$

$4\neq 5$

$(3,-1)$ $3(3)+4(-1)=5$ ✓

$9-4=5$

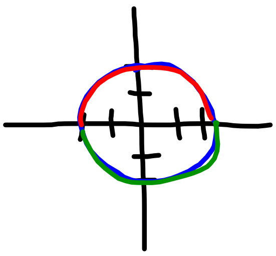
$5=5$

Defining graphs implicitly

Solve for y

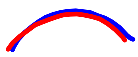
$$x^2 + y^2 = 4$$

$$-x^2 \qquad -x^2$$



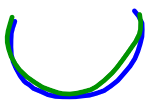
$$y^2 = 4-x^2$$

$$y = \pm\sqrt{4-x^2}$$



$y=\sqrt{4-x^2}$

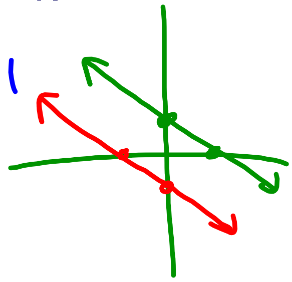
$y=-\sqrt{4-x^2}$



Using Implicitly Defined Functions

Describe the graph of the relation $\underbrace{x^2 + 2xy}$ $+ y^2 = 1$.

$(x+y)(x+y) = 1$



$(x+y)^2 = 1$

$x + y = \pm\sqrt{1}$

$x + y = 1 \qquad x + y = -1$

$\boxed{y = -x + 1} \qquad \boxed{y = -x - 1}$

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Find two functions defined implicitly by the given relation.

$x^2 + y^2 = 25$

$y^2 = 25 - x^2$

$y = \pm\sqrt{25 - x^2}$

HW 21-27 by 3's, 36, 39, 40