Math 121 S09N03 - Quiz 1 Name: SOLUTIONS.
Jan 16 2009 Stu#:

(1) [5 points] Let $f(x) = 4 + 3x - x^2$. Find and simplify $\dfrac{f(3+h) - f(3)}{h}$.

$$\frac{f(3+h) - f(3)}{h}$$

$$= \frac{[4+3(3+h)-(3+h)^2]-[4+3(3)-3^2]}{h}$$

$$= \frac{\cancel{4}+\cancel{9}+3h-\cancel{9}-6h-h^2\cancel{-4}\cancel{-9}\cancel{+9}}{h}$$

$$= \frac{-3h-h^2}{h}$$

$$= -3-h$$

(2) [5 points] Let $f(x) = x + \dfrac{1}{x}$ and $g(x) = \dfrac{x+1}{x+2}$. Find $(f \circ g)(x)$ and state the domain.

$$(f\circ g)(x) = f(g(x))$$
$$\left.= \frac{x+1}{x+2} + \frac{1}{\left(\frac{x+1}{x+2}\right)}\right\} *$$
$$= \frac{x+1}{x+2} + \frac{x+2}{x+1}$$
$$= \frac{x^2+2x+1+x^2+4x+4}{(x+1)(x+2)}$$
$$= \frac{2x^2+6x+5}{(x+1)(x+2)}$$

Using $*$, must have

$x+2 \neq 0$ & $\dfrac{x+1}{x+2} \neq 0$

$\therefore x \neq -2$, $x \neq -1$

$\therefore$ domain of $f\circ g$ is

$\{x \mid x \neq -2, x \neq -1\}$,

or

$(-\infty,-2)\cup(-2,-1)\cup(-1,\infty)$.

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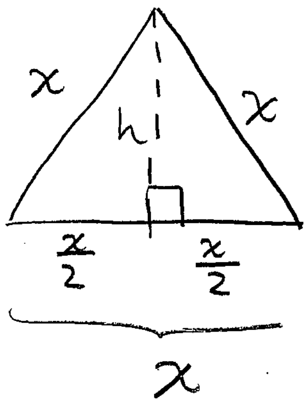
(3) [**5 points**] An equilateral triangle has side length x. Express the area of the triangle as a function of the side length.



$$A = \frac{1}{2} x h$$

Using Pythagoras' Theorem,

$$h^2 + \left(\frac{x}{2}\right)^2 = x^2,$$

$$\therefore h = \sqrt{x^2 - \frac{x^2}{4}}$$

$$= \sqrt{\frac{3x^2}{4}}$$

$$= \frac{\sqrt{3}}{2} x$$

$$\therefore A = \frac{1}{2} x \left(\frac{\sqrt{3}}{2} x\right)$$

$$= \frac{\sqrt{3}}{4} x^2 .$$