MATH 1A − QUIZ 1

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Name:_____

Instructions: You have 10 minutes to do this quiz, for a total of 10 points. **Show your work, unless otherwise specified!** Good luck, and may πm be with you!

(1) *(3 points)* Find the domain of $f(x) = \cos(\frac{1}{x})\sqrt{(x-3)^2-4}$ We want:

1) $\boxed{x \neq 0}$ (because we want the denominator of the fraction $\frac{1}{x}$ to be nonzero)

2) $(x-3)^2-4 \geq 0$ (because we want the number under the square root to be ≥ 0.

Solving this, we get: $(x-3)^2 \geq 4$, that is $x-3 \leq -2$ or $x-3 \geq 2$, so $\boxed{x \leq 1 \text{ or } x \geq 5}$

3) Combining, we get: $x \neq 0$ and ($x \leq 1$ or $x \geq 5$)

Answer: $\boxed{\text{Dom(f)} = (-\infty, 0) \cup (0, 1] \cup [5, \infty)}$[1]

(2) *(2 points)* Find the range of $f(x) = 3\sin(x) + 2$. Here you do **NOT** have to show any work.

You could either draw the graph of f, or do it algebraically:

$$-1 \leq \sin(x) \leq 1$$
$$-3 \leq 3\sin(x) \leq 3$$
$$-1 \leq 3\sin(x) + 2 \leq 5$$

Hence $\boxed{\text{Ran(f)} = [-1, 5]}$

Date: Friday, September 6th, 2013.

[1] which you can also write as 'the set of x such that $x < 0$ or $0 < x \leq 1$ or $x \geq 5$'

(3) *(2 points)* Find $f \circ f$ (f composed with f), where $f(x) = \frac{1}{x+1}$. Write your answer in the form of a fraction, i.e. $\frac{ax+b}{cx+d}$, where a, b, c, d are integers.

$$(f \circ f)(x) = f(f(x)) = f(X) = \frac{1}{X+1} = \frac{1}{\frac{1}{x+1}+1} = \frac{1}{\frac{1+(x+1)}{x+1}} = \frac{1}{\frac{x+2}{x+1}} = \frac{x+1}{x+2}$$

(4) *(3 points)* Explain **in words** how to obtain the graph of $f(x) = 2\sin(-x+3)+4$ from the graph of $y = \sin(x)$. You do **not** have to draw any graphs!

Note: The following vocabulary may be useful: Stretch/Compress horizontally/vertically by a factor of $\cdots$, shift up/down/left/right, Flip across the x/y-axis.

Note: There are many answers to this problem, here are my two favorite ones:

Answer 1 (horizontal, then vertical): First we start with the graph of $y = \sin(x)$, and then we:

1) Shift the resulting graph left by 3 units (to obtain $\sin(x+3)$)
2) Flip the resulting graph (horizontally) across the $y-$axis (to obtain $\sin(-x+3)$)
3) Stretch the resulting graph vertically by a factor of 2 (to obtain $2\sin(-x+3)$)
4) Shift the resulting graph up by 4 units (to obtain $2\sin(-x+3)+4$)

Answer 2 (vertical, then horizontal): First we start with the graph of $y = \sin(x)$, and then we:

1) Stretch the resulting graph vertically by a factor of 2 (to obtain $2\sin(x)$)
2) Shift the resulting graph up by 4 units (to obtain $2\sin(x)+4$)
3) Shift the resulting graph left by 3 units (to obtain $2\sin(x+3)+4$)
4) Flip the resulting graph (horizontally) across the $y-$axis (to obtain $2\sin(-x+3)+4$)