MATH 1007F **Tutorial #1 – solution** **14 January 2013**

Please work in teams of 4. At the end of the tutorial every team hands in one set of solutions with everybody's name and student number PRINTED, and everybody's signature.

Don't worry if you can't finish all the questions; what you haven't finished in class, finish at home. The main goal of the tutorial is to learn by working together. The tutorial problems are intended to be an enjoyable learning experience, **not** a competition. Anyone regularly participating in tutorials can expect a reasonable grade for the tutorial work.

Do **NOT** divide up the problems between you and work on them separately. Groups doing this will be marked in a tougher fashion. You and your group should work **together** on all problems, sharing insights and difficulties as you progress.

Your TA is here to help you – don't be shy to ask questions. If I'm around, do the same with me!

1. **Simplify** as much as possible

a. $(-32)^{2/5}$ b. $-32^{2/5}$ c. $(\sqrt[7]{8x^3})^{7/3}$ d. $\dfrac{\frac{a}{3b}-\frac{b}{a}}{b}+\dfrac{1}{a}$ e. $\left(\dfrac{2ab^{-1}}{6a^2b^{-3}}\right)^{-2}$

SOLUTION:

a. $(-32)^{2/5} = (-2)^2 = 4$

b. $-32^{2/5} = -2^2 = -4$

c. $\left(\sqrt[7]{8x^3}\right)^{7/3} = \left(\sqrt[7]{(2x)^3}\right)^{7/3} = \left(\left((2x)^3\right)^{1/7}\right)^{7/3} = \left((2x)^{3/7}\right)^{7/3} = 2x$

d.

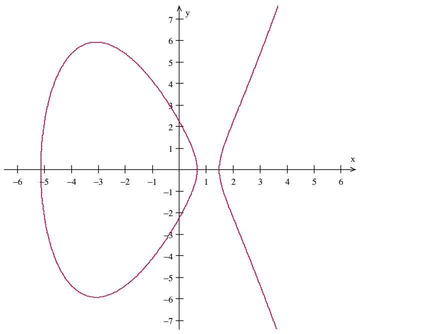
$$\frac{\frac{a}{3b}-\frac{b}{a}}{b}+\frac{1}{a} = \frac{\frac{a^2-3b^2}{3ab}}{b}+\frac{1}{a} = \frac{a^2-3b^2}{3ab^2}+\frac{1}{a} = \frac{a^2-3b^2}{3ab^2}+\frac{3b^2}{3ab^2} =$$

$$\ldots = \frac{a^2-3b^2+3b^2}{3ab^2} = \frac{a}{3b^2}$$

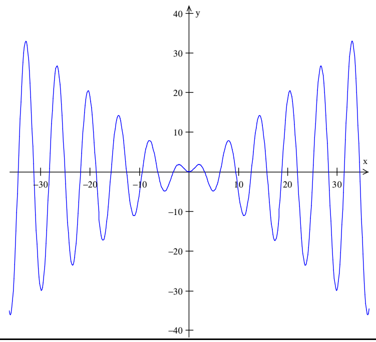
e. $\left(\dfrac{2ab^{-1}}{6a^2b^{-3}}\right)^{-2} = \left(\dfrac{b^2}{3a}\right)^{-2} = \left(\dfrac{3a}{b^2}\right)^{2} = \dfrac{9a^2}{b^4}$

2. Which of the following is the graph (or graphical representation) of a function? Explain.

a.



b.



c. $\{(0,-1),(0,1),(2,-3),(2,3),(4,-5),(4,5)\}$

d. $\{(0,-1),(1,-1),(2,-2),(3,-2),(4,-3),(5,-3)\}$

SOLUTION:

a. No, because there are 2 values of *y* associated with each value of *x* (except for the case where the curve crosses the *x* – axis).
b. Yes. Every value of *x* in the domain of the function has one (and only one) image.
c. No. The values of *x* in the domain of the function ALL have 2 images.
d. Yes. The values of *x* in the domain of the function ALL have one (and only one) image. The *x*-coordinates are not repeated in the list of ordered pairs.

3. **Determine the equation of a line** that passes through the point (–4, –4) and is parallel to the line 2*y* + 3*x* – 6 = 0.

SOLUTION:

$2y + 3x - 6 = 0 \Rightarrow y = -\frac{3}{2}x + 3 \Rightarrow$ slope : $-3/2$

$\therefore$ The equation of the line is: $y = -3/2\,x + b$

But line passes through $(-4,-4)$, so:

$$-4 = -\frac{3}{2}(-4) + b \Rightarrow b = -10$$

$\therefore$ Equation : $y = -\frac{3}{2}x - 10 \Rightarrow 2y + 3x + 20 = 0$

4. **Determine the domain** of the following functions, whose rule is given by:

SOLUTION:

a. $f(x)=3x^3-5x+12$ dom (f) = $\mathbb{R}$, because this is a polynomial	b. $f(x)=\ln(3x+8)$ We require $3x+8>0 \Rightarrow x>-8/3$ ... i.e. dom (f) = $\left(-8/3,+\infty\right)$
c. $g(x)=\dfrac{2x^2+5}{4-12x}-\sqrt{x+1}$ We require $4-12x\neq 0$ AND $x+1\geq 0$,so dom (g) = $x\neq 1/3$ AND $x\geq -1$ ... i.e. dom (g) = $\left[-1,1/3\right)\cup\left(1/3,+\infty\right)$	d. $f(x)=\sqrt[4]{x^2-1}+\sqrt{2-x}$ We require $x^2-1\geq 0$ AND $2-x\geq 0$, so dom (f) = $(x\leq -1$ OR $x\geq 1)$ AND $x\leq 2$ ... i.e. dom (f) = $\left(-\infty,-1\right]\cup\left[1,2\right]$

5. **Solve for x. For the equalities, express the solution as an interval or a union of intervals.**

a. $3x-6 \leq 7(2+x)$	b. $\lvert 2x+5\rvert = 9-x$	c. $\dfrac{1}{x}\geq -4$
d. $\lvert x-3\rvert > 2$	e. $\dfrac{3-2x}{\lvert x-3\rvert}\geq -4$	

a. $3x-6 \leq 7(2+x)$

$3x-6 \leq 14+7x$

$-4x \leq 20$

$x \geq -5$

$[-5,+\infty)$

b. $|2x+5| = 9-x \overset{①}{\Rightarrow}$ $2x+5 = 9-x$ if $2x+5\geq 0$ $(x\geq -5/2)$

$3x=4$

$x=4/3 \leftarrow$ consistent

OR

$\overset{②}{\Rightarrow}$ $2x+5 = x-9$ if $2x+5<0$ $(x<-5/2)$

$x=-14 \leftarrow$ consistent

$\boxed{\therefore\ x=-14 \text{ OR } x=4/3}$

c. $\frac{1}{x} \geq -4$ $(x \neq 0)$

CASE 1: $x > 0 \Rightarrow -4x \leq 1$

$x \geq -1/4$

solution : $(0, +\infty)$

CASE 2: $x < 0 \Rightarrow -4x \geq 1$

$x \leq -1/4$

solution : $(-\infty, -1/4]$

$\therefore$ SOLUTION IS : $(-\infty, -1/4] \cup (0, +\infty)$

d. $|x-2| > 2 \overset{1}{\Rightarrow} x - 2 > 2$ if $x-2 \geq 0$ $(x \geq 2)$

$x > 4$

SOLUTION : $(4, +\infty)$

OR

$\overset{2}{\Rightarrow} x - 2 < -2$ if $x-2<0$ $(x<2)$

$x < 0$

SOLUTION : $(-\infty, 0)$

$\therefore$ SOLUTION : $(-\infty, 0) \cup (4, +\infty)$

e. $\dfrac{3-2x}{|x-3|} \geq -4$ $(x \neq 3)$

$\stackrel{①}{\Longrightarrow} \dfrac{3-2x}{x-3} \geq -4$ if $x-3>0$ $(x>3)$

$3-2x \geq \overset{-4(x-3)}{-4x+12}$

$2x \geq 9$

$x \geq 9/2 = 4.5$

SOLUTION: $[9/2, +\infty)$

OR

$\stackrel{②}{\Longrightarrow} \dfrac{3-2x}{-(x-3)} \geq -4$ if $x-3<0$ $(x<3)$

$3-2x \geq 4x-12$

$-6x \geq -15$

$x \leq 5/2 = 2.5$

SOLUTION: $(-\infty, 5/2]$

$\therefore$ SOLUTION: $(-\infty, 5/2] \cup [9/2, +\infty)$