Mathematics Department	1st bimester, FS 2011
Mr. Neeman	Total points possible: 20
Quiz #2	Solutions
Topic: Power laws and exponential functions	Estimated time: 40 minutes

Instructions: Answer all the questions, showing your work neatly. Remember to check your answers afterwards.

#1. For each of the following, circle "Y" if it's an exponential function and "N" if it isn't. (1 pt each)

(a) 4^x Yes

(b) x^4 No

(c) x^{-x} No

(d) $(3^3)^x$ Yes (it's 9^x)

(e) 1^x No ($1^x = 1$, regardless of what x is, so it's a constant function)

(Recall also in the definition of exponential functions as a^x it was with $a > 0$ and $a \neq 1$)

#2. Simplify each of the following expressions. (1 pt each)

(a) $\dfrac{(ab^{-1})^2}{a^3b} = \dfrac{a^2b^{-2}}{a^3b} = \dfrac{1}{ab^3}$

(b) $\left(\dfrac{a}{3}\right)^{-2}\left(\dfrac{2b}{a}\right)^3 = \dfrac{9}{a^2}\dfrac{8b^3}{a^3} = \dfrac{72b^3}{a^5}$

(c) $\dfrac{a^{-2}\sqrt{b}}{(a^6b^3)^{\frac{1}{2}}} = \dfrac{a^{-2}b^{\frac{1}{2}}}{a^3b^{\frac{3}{2}}} = \dfrac{1}{a^5b}$

#3. Consider the function $f(x) = \left(\frac{2}{3}\right)^x$.

(a) Find the image of 2. (1 pt)
$f(2) = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$

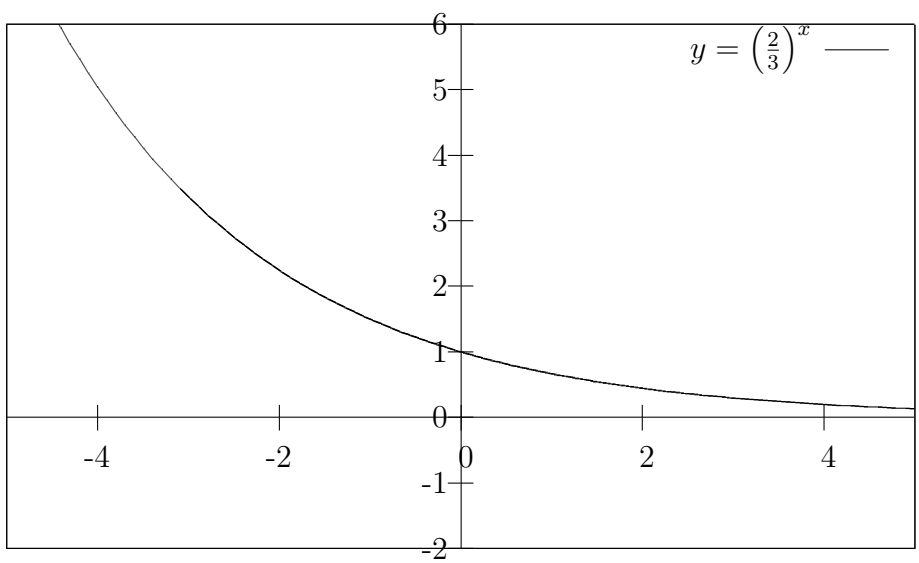
(b) Find the preimage of 1. (1 pt)
$\left(\frac{2}{3}\right)^x = 1$
Therefore, $x = 0$ (recall that $a^0 = 1$ if $a > 0$ and $a \neq 0$). It is also clear from the the graph (which intersections the y-axis at $y = 1$).

(c) Is the function injective? (1 pt)
Yes

(d) Is the function bijective? (1 pt)
No

(e) What is the function's range? (1 pt)
$]0, \infty[$

(f) Sketch the functions graph, identifying any intersections with the axes. (1 pt)

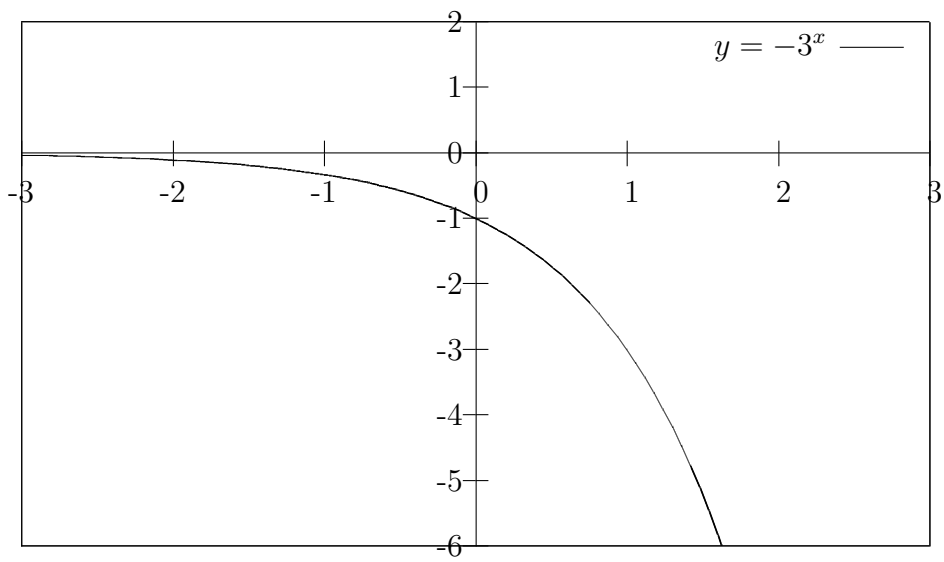


#4. Consider the function $f(x) = -3^x$.

(a) Is the function increasing or decreasing? (1 pt)
Decreasing.

(b) What is the function's concavity? (1 pt)
Concave down.

(c) Find the preimage of $-\sqrt{3}$. (1 pt)
$-\sqrt{3} = -3^x$
$\sqrt{3} = 3^x$
$3^{\frac{1}{2}} = 3^x$
Therefore, $x = \frac{1}{2}$.

(d) What is the function's range? (1 pt)
$]-\infty, 0[$

(e) Sketch the function's graph, identifying any intersections with the axes. (1 pt)