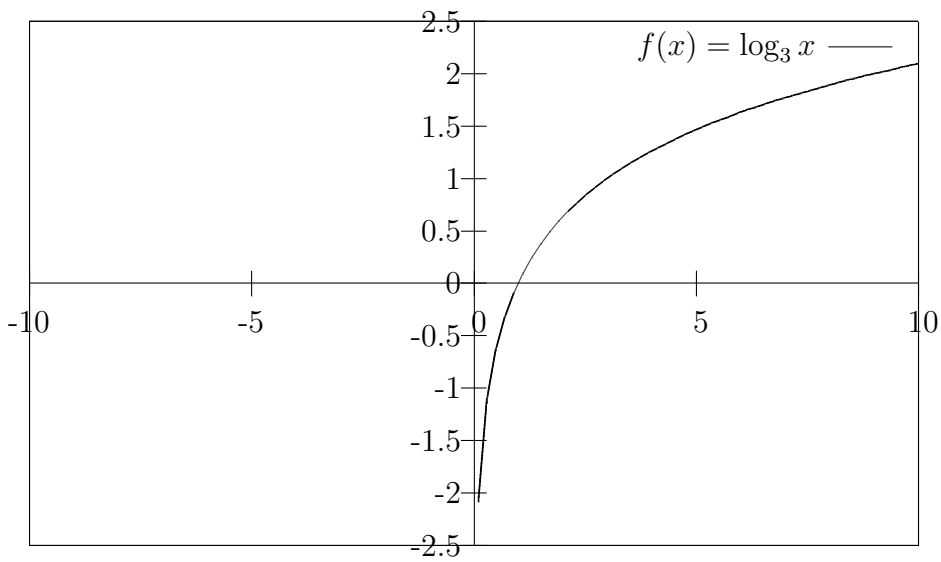
Mathematics Department	1st bimester, FS 2011
Mr. Neeman	Total points possible: 20
Quiz #3, 10B	Solutions
Topic: Logarithmic functions	Estimated time: 40 minutes

Instructions: Answer all the questions, showing your work neatly. Remember to check your answers afterwards. Leave your answers exact (don't approximate as decimals).

#1. Consider the function $f(x) = \log_3 x$.
(a) Find the image of $\frac{1}{9}$. (1 pt)
$\log_3 \frac{1}{9} = \log_3(3^{-2}) = -2$
(b) Find the preimage of $\frac{3}{2}$. (1 pt)
$\frac{3}{2} = \log_3 x$
$3^{\frac{3}{2}} = x$
$x = \sqrt{27}$
(c) Find the function's intersection with the x axis. (1 pt)
$0 = \log_3 x$
$3^0 = x$
$x = 1$
(d) Sketch the function's graph, labeling your result from (c). (1 pt)

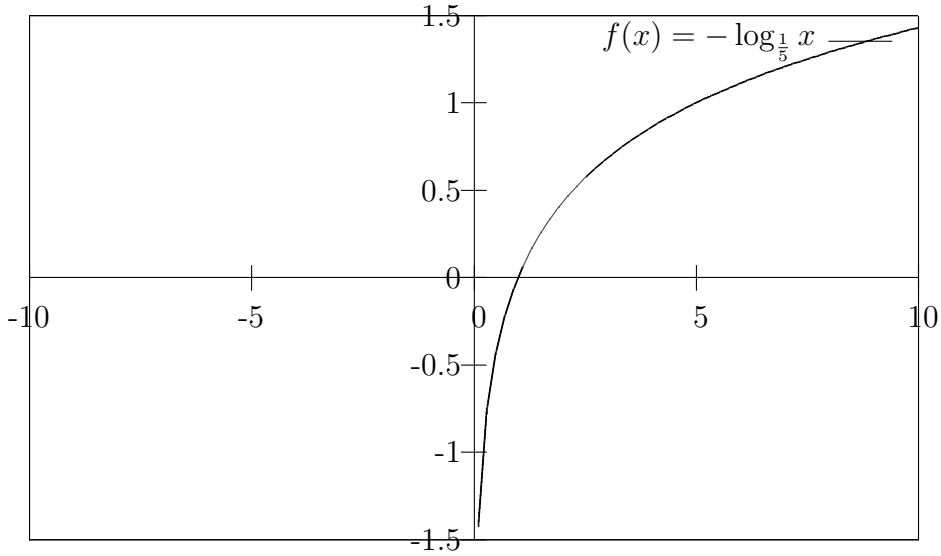


The intersection is at $x = 1$.
(e) What is the function's range? (1 pt)
$\mathbb{R}$

#2. Solve the following equations:
(a) $\log_2(3x - 2) = 5$ (2 pts)
$3x - 2 = 2^5$
$3x - 2 = 32$
$3x = 34$
$x = \frac{34}{3}$

(b) $3^{x^2} + 4 = 10$ (2 pts)
$3^{x^2} = 6$
$x^2 = \log_3 6$
$x = \pm\sqrt{\log_3 6}$

#3. Consider the function $f(x) = -\log_{\frac{1}{5}} x$.
(a) Sketch the function's graph, labeling the intersection with the x axis. (1 pt)



The intersection is at $x = 1$.

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

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

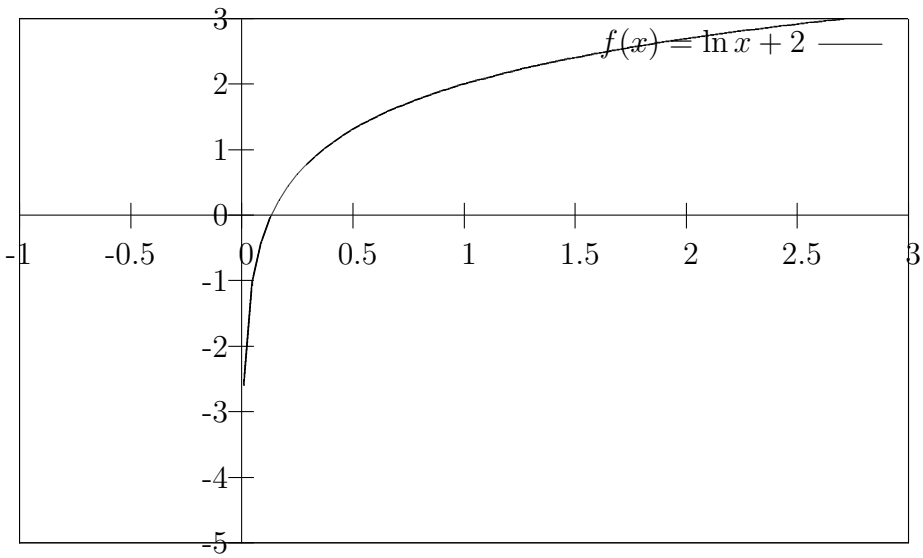
(d) Is the function increasing or decreasing? (1 pt)
Increasing.

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

#4. Consider the function $f(x) = 2 + \ln x$.
(a) Find the image of $\sqrt{e}$. (1 pt)
$2 + \ln\sqrt{e} = 2 + \ln(e^{\frac{1}{2}}) = 2 + \frac{1}{2} = \frac{5}{2}$

(b) Find the preimage of 0. (1 pt).
$0 = 2 + \ln x$
$-2 = \ln x$
$e^{-2} = x$
$x = \frac{1}{e^2}$

(c) Sketch the function's graph, labeling the intersection with the x axis. (1 pt)



The intersection is at $x = \frac{1}{e^2}$.

(d) Is the function surjective? (1 pt)
Yes

(e) What is the equation of the function's asymptote? (1 pt)
$x = 0$

#5. Simplify $e^{\ln(x^2)-2}$. (1 pt)
$= \frac{e^{\ln(x^2)}}{e^2}$
$= \frac{x^2}{e^2}$