

NAME (print): KEY - There were two different versions of the exam

Math 108 Summer 2009—Exam I

Instructor: Dr. J. Shapiro

Work carefully and neatly and remember that I cannot grade what I cannot read. In the long answer questions you must show all relevant work in the appropriate space. You may receive no credit for a correct answer if there is insufficient supporting work. Place your answers in the boxes provided. Notes, books and graphing calculators are NOT ALLOWED.

Problems 1 – 3 are multiple choice. Circle the correct answer:

[16pt] 1. Evaluate and simplify the following expressions:

(a) 3^{-2}
a) $1/6$ b) 9 c) 6 d) -6 e) $1/9$

(b) $(36)^{1/2}$
a) 18 b) 6 c) 9 d) $1/6$ e) $1/9$

(c) $\frac{2(16)^{3/4}}{2^3}$
a) 2 b) 4 c) 16 d) $1/4$ e) $1/2$

(d) $\frac{a^5 a^{-3}}{a^2 + a^3}$
a) $1/a^3$ b) a^3 c) $\frac{a^2}{a^2 + a^3}$ d) a^2 e) $\frac{1}{1+a}$ **Either is correct**

[10pt] 2. Solve the following equations for x :

(a) $x^2 - 5x - 6 = 0$
a) $x = 1, -6$ b) $x = 2, -3$ c) $x = -2, 3$ d) $x = -1, 6$ e) equation does not have any real solutions

(b) $|2x - 3| \leq 5$
a) $x \leq 4$ b) $-1 \leq x \leq 4$ c) $x \geq 5$ or $x \leq -2$ d) $x \geq 8$ or $x \leq -2$
e) $x = 0$

[12pt] 3. Find the domain of the following functions:

(a) $f(x) = x^3 - 16x^2 + 10$

- a) all reals $x \neq 10$ b) $x \geq 10$ **c) all reals** d) $x \geq 0$ e) all reals $x \neq 3, 6$

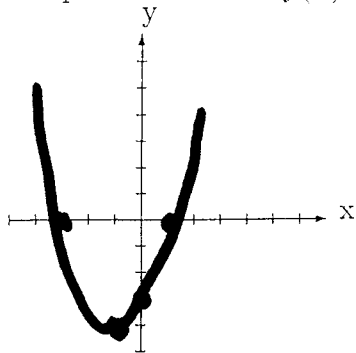
(b) $f(x) = \frac{x}{x^2 - x}$

- a) all reals $x \neq 0, 1$** b) all $x > 0$ c) all reals d) all reals $x \neq 2$
e) $x \geq 1$ or $x \leq 0$

(c) $f(x) = \sqrt{x+5}$

- a) $x \geq -5$** b) $x \geq 5$ c) $x \geq 0$ d) $x \leq -5$ e) $x \leq 0$

[8pts] 4. Graph the function $f(x) = x^2 + 2x - 3$. Include the vertex and all intercepts.



$$x^2 + 2x - 3 = 0 \quad \Bigg| \quad x = \frac{-b}{2a} = -1$$

$$(x-1)(x+3) = 0 \quad \Bigg| \quad f(-1) = -4$$

$$x = 1, x = -3$$

x-ints $(-3, 0), (1, 0)$
y-int $(0, -3)$
Vertex $(-1, -4)$

[8pts] 5. Find the equation of the line (in slope-intercept form) that is through the point (1, 3) and perpendicular to the line $2y - 6x = 4$.

$$2y - 6x = 4$$

$$y = 3x + 2$$

$$\perp \text{ slope} = -\frac{1}{3}$$

$$\text{Get } (y-3) = -\frac{1}{3}(x-1)$$

Answer:

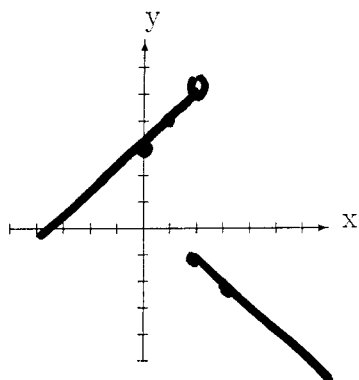
$$y = -\frac{1}{3}x + \frac{10}{3}$$

$$y - 3 = -\frac{1}{3}x + \frac{1}{3}$$

$$y = -\frac{1}{3} + \frac{1}{3} + 3 = \frac{9}{3}$$

6. Let $y = f(x) = \begin{cases} x + 3 & \text{if } x < 2. \\ -2x + 3 & \text{if } x \geq 2. \end{cases}$

[8pts] (a) Graph $f(x)$ below.



x	y
-1	4
0	3
1	2
2	-1
3	-3

[4pts] (b) What is $f(2)$?

$$f(2) = -2(2) + 3 = \boxed{-1}$$

[4pts] (c) What is $f(1.9)$?

$$f(1.9) = 1.9 + 3 = \boxed{4.9}$$

[12pts] 7. Let $f(x) = \frac{2x}{3x-1}$ and $g(x) = 2x + 2$.

(a) Find $f(3)$

$$\frac{2(3)}{3(3)-1} = \frac{6}{9-1} = \frac{6}{8}$$

Answer: $\frac{3}{4}$

(b) Find $f(g(x))$.

$$f(2x+2) = \frac{2(2x+2)}{3(2x+2)-1} = \frac{4x+4}{6x+6-1} = \frac{4x+4}{6x+5}$$

Answer: $f(g(x)) = \frac{4x+4}{6x+5}$

[8pts] 8. Find the point(s) of intersection of the two functions $f(x) = 1/x$ and $g(x) = x - 1$ (give both the x and y coordinates).

$$\left(\frac{1}{x} = x - 1\right) \times$$

$$1 = x^2 - x$$

$$0 = x^2 - x - 1 \text{ (Does not factor)}$$

$$x = \frac{1 \pm \sqrt{1 - 4(1)(-1)}}{2} = \frac{1 \pm \sqrt{5}}{2}$$

Answer: $\left(\frac{1+\sqrt{5}}{2}, -\frac{1+\sqrt{5}}{2}\right), \left(\frac{1-\sqrt{5}}{2}, -\frac{1-\sqrt{5}}{2}\right)$
 plug into $g(x)$
 $\frac{1+\sqrt{5}}{2} - 1 = \frac{-1+\sqrt{5}}{2}$
 $\frac{1-\sqrt{5}}{2} - 1 = \frac{-1-\sqrt{5}}{2}$

[10pts] 9. A movie theater owner finds that if tickets cost \$6 apiece, then he sells 150 tickets. For each \$.50 increase in price, he sells 10 less tickets. Express the revenue R as a function of x the number of \$.50 increases in the ticket price.

at \$6 \rightarrow sell 150 tickets

Answer:
 $R(x) = -5x^2 + 15x + 900$

$$R = (\text{price of a ticket}) \cdot (\# \text{ tickets sold})$$

$$= (6 + .50x) \cdot (150 - 10x)$$

$$= 900 + 75x - 60x - 5x^2$$

$$= -5x^2 + 15x + 900$$