

NAME:

Key

1. [6] TRUE/FALSE: Circle T in each of the following cases if the statement is *always* true. Otherwise, circle F. Let  $f$  be a function, and  $x$ ,  $y$ , and  $z$  be real numbers with  $z \neq 0$ .

T  F  $\frac{3}{a} + \frac{4}{a^2} = \frac{3}{a} + \frac{\sqrt{4}}{\sqrt{a^2}} = \frac{5}{a}$

$\frac{a^3}{a} + \frac{4}{a^2} = \frac{3a+4}{a^2}$

T F  $(f+f)(x) = f(x) + f(x)$

T  F  $(x+3)^2 = x^2 + 9$

$(x+3)(x+3) = x^2 + 3x + 3x + 9 = x^2 + 6x + 9$

T F  $i^2 = -1$

T  F  $(2+3i)(1-i) = 2*1 + 3*(-1)i = 2 - 3i$

$(2+3i)(1-i) = 2 - 2i + 3i - 3i^2$   
 $= 2 + i - 3(-1)$   
 $= 5 + i$

T  F A quadratic polynomial always has five complex roots.

$\rightarrow$  always has two complex roots

Show your work for the following problems. The correct answer with no supporting work will receive NO credit (this includes multiple choice questions).

2. [3] (PracticeExam #3) Solve for  $y$  given  $\frac{-y}{1+y} = x$

$(1+y) \frac{-y}{1+y} = x (1+y)$

$-y = x + xy$

$-xy \quad -xy$

$-y - xy = x$

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

$y = \frac{x}{-x-1} \text{ or } \frac{-x}{x+1}$

start (+.5)

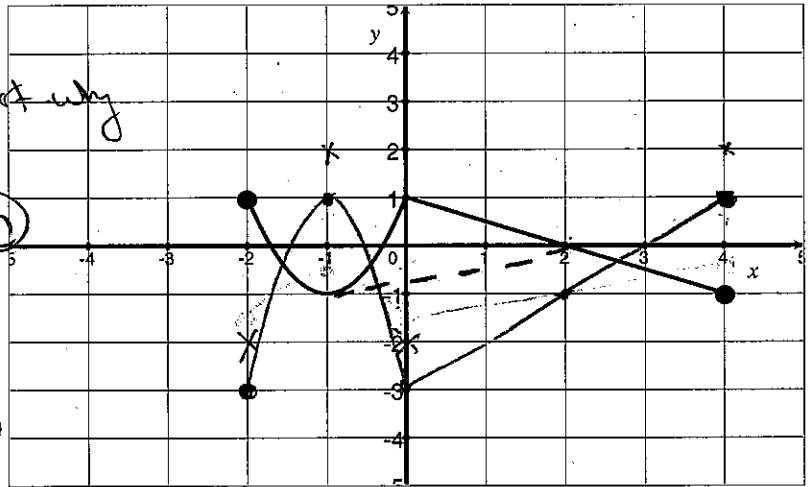
fractions (+.5)

distribute (+.5)

legal algebra (+1)

y on one side (+.5)

3. Let  $f$  be the function comprised of one line and a parabola whose graph is below:



(a) [2] (WebHW2 #11)  
 Is  $f$  a function?  $(+1.5)$  *Start why*  
 Why or why not.  
*yes (+1.5)*  
*each input has at most one output (+1)*

(b) [4] (Quiz2 #1)  
 Estimate the following if possible:  
 i.  $f(3) \approx -0.5$   $(+1)$

ii.  $(f \circ f)(0)$  *composition (+1.5)*  
 $f(f(0)) = f(1) \approx 0.5$   
 iii.  $3f(4)$   $(+1)$   
 $3(-1) = -3$   $(+1.5)$

(c) [2] (Quiz1 #3) Find  $x$  so that  $f(x) = 1$ .  
*inputs with an output of 1*  $(+1.5)$   
 $0$  and  $-2$  *get one (+1.5)*  
 $(+1.5)$   $(+1.5)$

(d) [3] (TransformationWks #5) Draw the graph of  $g$  if  $-2f(x) - 1 = g(x)$   
*get it (+1.5)* *order (+1.5)*  
 1) vertical flip & stretch by 2 xxx  
 2) vertical shift down 1  $(+1.5)$

(e) [1] (§1.1 #48) Identify the  $y$  intercept of  $f$ .  
 $1$

(f) [2] (WebHW2 #14) Find the average rate of change of  $f$  from  $x = -1$  to  $x = 2$

$(+1.5)$  slope of dashed line  $(+1.5)$   $(+1.5)$   $(+1.5)$   $(+1)$

$$\frac{\text{rise}}{\text{run}} = \frac{1}{3}$$

or

$$\frac{f(2) - f(-1)}{2 - (-1)} = \frac{0 - (-1)}{2 + 1} = \frac{1}{3}$$

$(+1)$   $(+1)$

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4. Let  $h = \frac{1}{3}x - 1$

(a) [1] (WebHW1 #19)

Graph  $h$ . slope  $\frac{1}{3}$   
 got it  $\frac{1}{3}$

(b) [2] (LineWks #12)

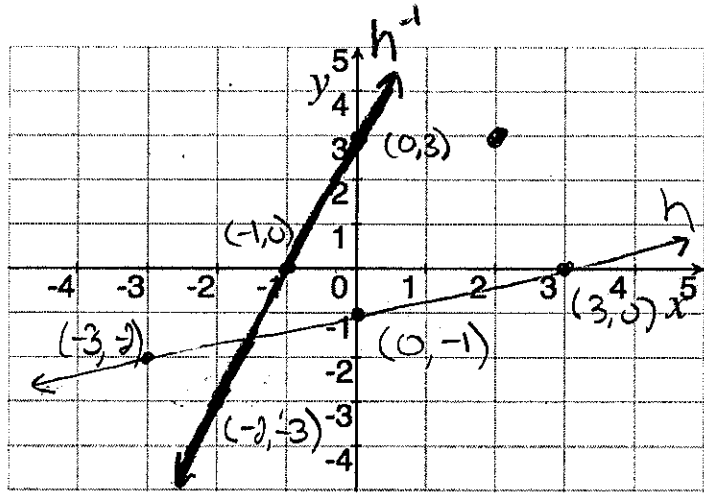
Find the equation of a line parallel to  $h$  that also passes through  $(2, 3)$ .

$\frac{1}{3}$  same slope so  $\frac{1}{3}$

$\frac{1}{3}$   $y - y_1 = m(x - x_1)$  or  $\frac{1}{3}$   $3 = \frac{1}{3}(2) + b$  so

$\frac{1}{3}$   $y - 3 = \frac{1}{3}(x - 2)$

$\frac{1}{3}$   $y = \frac{1}{3}x + \frac{7}{3}$



(c) [2] (InverseWks #2) Graph  $h^{-1}$ .

$\frac{1}{3}$  if  $(x, y)$  is on graph of  $h$ , then  $(y, x)$  is on the graph  $h^{-1}$

(d) [2] (§1.7 #56) Find the equation for  $h^{-1}$

$\frac{1}{3}$  slope =  $\frac{3}{1}$

$\frac{1}{3}$  y-intercept of 3

$\frac{1}{3}$  line  $\Rightarrow y = 3x + 3$   $\frac{1}{3}$

5. Let  $p(x) = x^2 + 6x + 10$

(a) [1] (§1.3 #32) Find  $p(2+k) = \overset{+.5}{(2+k)}^2 + 6\overset{+.5}{(2+k)} + 10$   
 $= (2+k)^2 + 6(2+k) + 10$

(b) [3] (§2.1 #50) Write  $p(x)$  in vertex form.

$$y = x^2 + 6x + 10$$

$$+ \left(\frac{6}{2}\right)^2 + \left(\frac{6}{2}\right)^2$$

$$y + 9 = x^2 + 6x + 9 + 10$$

$$y + 9 = (x+3)^2 + 10$$

$$y = (x+3)^2 + 1$$

Know vertex form  $(+.5)$   
 algebra  $(+.5)$   
 notation  $(+.5)$

(c) [2] (Practice Exam #2) Find the real or complex roots of  $p(x)$ .

$(+.5) 0 = x^2 + 6x + 10$

quad formula  $(+.5)$   
 used right  $(+.5)$   
 $x = \frac{-6 \pm \sqrt{36 - 4(1)(10)}}{2(1)}$   
 $= \frac{-6 \pm \sqrt{-4}}{2} = -3 \pm i$

$(+.5) 0 = (x+3)^2 + 1$

or  $-1$

$-1 = (x+3)^2$

$\pm \sqrt{-1} = x+3$

$-3 \pm i = x$

algebra  $(+.5)$   
 $\pm$   $(+.5)$

6. [4] (Word Problem #12) You are standing on the top of a 200 ft tower and toss a penny up at a velocity of 8ft/sec. At time  $t$  seconds after the toss the velocity of the penny is  $v(t) = -32t + 8$  and the distance from the sidewalk is given by  $p(t) = -16t^2 + 8t + 200$ .

- (a) How long is the penny in the air?  
 (b) How fast is it going when it hits the ground?

a) i.e. when does the penny hit the ground?  $(+.5)$

i.e. when is  $p(t) = 0$   $(+.5)$

$$0 = -16t^2 + 8t + 200$$

quadratic formula  $(+.2)$  or

$$t = \frac{-8 \pm \sqrt{8^2 - 4(-16)(200)}}{2(-16)}$$

$$= \frac{-8 \pm \sqrt{12864}}{-32}$$

$$= \frac{-8 \pm 113.4}{-32} = -3.29 \text{ or } 3.79$$

$\rightarrow$  doesn't make sense  $(+.5)$

complete  $\square$   $(+.2)$

$$\frac{0}{-16} = \frac{-16t^2 + 8t + 200}{-16} \quad (+.5)$$

$$0 = t^2 - \frac{1}{2}t - \frac{25}{2}$$

$$+\left(\frac{1}{4}\right)^2 + \left(\frac{1}{4}\right)^2$$

$$\frac{1}{16} = \left(t - \frac{1}{4}\right)^2 - \frac{25}{2}$$

$$+\frac{25}{2}$$

$$\frac{201}{16} = \left(t - \frac{1}{4}\right)^2$$

$$t = \frac{1}{4} \pm \sqrt{\frac{201}{16}} = 3.79 \text{ or } -3.29$$

$(+.5)$

b) i.e. plug answers from a into  $v(t)$   $(+.5)$   
 $v(3.79) = -113.28 \text{ ft/s}$

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7. [5] Choose *ONE* of the following. Clearly identify which of the two you are answering and what work you want to be considered for credit.

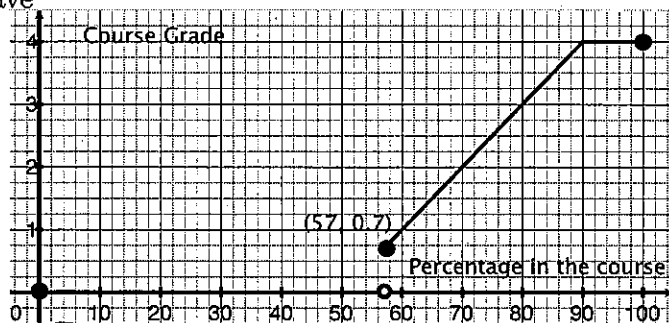
No, doing both questions will not earn you extra credit.

(a) Potassium ferrate has been considered for use in batteries but costs \$100 per gram. You have a battery case that is currently *full* with 50 grams of a mixture that is 10% potassium ferrate. You would like to build the battery but you need a higher concentration of the potassium ferrate (40% should do it). What is the minimum amount of potassium ferrate you have to buy and add to the battery case (after you dumped out some of the original mixture to make room) to get the cathode to work?

(b) Leonard McCoy is in this course and during the seventh week he logged into MyMathLab and computed the average of his WebAssign, WrittenHW's, Quizzes, and Exams. The numbers are reported below.

What grade does Leonard need on the final to earn a 2.5 in the class? The weights specified in the syllabus and the graph of the function  $f$  that takes your class percentage  $x$  and returns your score on a 4. scale are also provided.

	weight	McCoy's ave
Mini-Quizzes	5%	95%
WebAssign	10%	100%
WrittenHW	15%	95%
Quizzes	15%	65%
2 Exams	30%	70%
Final	25%	?



a) Let  $x$  = amount of mix you keep  
 $y$  = amount of mix you dump  
 want = keep + add  
 $4 \cdot 50 = .1x + y$   
 note  $x + y = 50$  so  $y = 50 - x$   
 $20 = .1x + 50 - x$  sub  
 $-50$                        $-50$   
 $-30 = -.9x$   
 $\frac{-30}{-.9} = \frac{-9}{-9}x$   
 $33.\bar{3} = x$  got it  
 so you dump out  $50 - 33.\bar{3}$   
 or 16.7 grams

b) Let  $x$  be marks on final exam  
 want % = % earned + % on final  
 $75 = 5 \cdot 95 + 10 \cdot 1 + 15 \cdot 95 + 15 \cdot 65 + 30 \cdot 7 + 25 \cdot x$   
 $75 = 59.75 + 10 + 142.5 + 97.5 + 210 + 25x$   
 $75 = 59.75 + 25x$   
 $-59.75$                        $-59.75$   
 $15.25 = 25x$   
 $\frac{15.25}{25} = \frac{25x}{25}$   
 $0.61 = x$  got it

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$$\begin{array}{r} 1 \\ 23 \\ 17 \\ \hline 5 \\ 45 \end{array}$$