

Show clear supporting work on problems with several steps. Algebraic problems that display little or no supporting work will get **little or no credit**. You do not need to show work on one-step calculator problems. To solve numerical problems guess-and-check is legal unless you are requested to solve them "algebraically." Find numerical answers with at least three correct significant digits:

1. a) Let  $c = -2$ . Find  $-3^2 + c^2$ .

$$-5 \quad (-3^2 = -9)$$

b) Evaluate, with at least three correct significant digits.

Let  $k = -1.87$

$$\frac{k + \pi}{1.23\sqrt{k^2 + 5(\pi - 2.3)}} = .3724$$

2. Short answer

a) In the notation " $f(x)$ ",  $f$  is the function.

In that context, what is " $x$ " called?

argument

b) What is the natural domain of  $f$ , when  $f(x) = \frac{1}{x^2 - 4}$

$$x \neq \pm 2$$

$$\{x \mid x \neq \pm 2\}$$

3. For all three parts of this problem, let  $f(x) = 2x - 9$ .

a) What is this particular  $f$ ? State it in English as a rule.

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b) Give and simplify  $f(f(x))$

$$2(2x - 9) - 9 = 4x - 27$$

c)  $f(x) = 2x - 9$ . Give  $g(x)$  and  $h(x)$ , neither equal to  $f(x)$ , such that  $f(x) = g(h(x))$

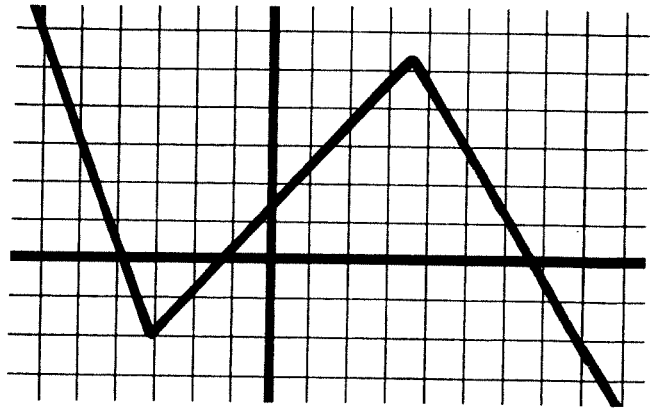
$$g(x) = x - 9 \quad h(x) = 2x$$

4. (Short answer.) Sometimes  $(x - 3)(x - 7) = c$  can be solved (for  $x$  as a real number) and sometimes it cannot. Look at a graph to answer this question: For which values of  $c$  is there a (real-valued) answer?

of  $y = (x - 3)(x - 7)$

Problem	points	score
1	8	
2	2,3	
3	10	
4	4	
5	8	
6	6	
7	10	
8	4	
9	6	
10	12	
11	6	
12	3,6	
13	4	
14	8	
total	100	

5. Here is a representative graph of  $f$ . Grid lines are one unit apart. Use the graph to approximate the answers.



a) Find  $f(3)$

*p. 44 Example 3*

b) Solve  $f(x) = 2$

*p. 44 Example 3*

c) Solve  $f(x) = x - 3$ .

*p. 44 Example 4*

6. Figure 1 is a representative graph of a line in the window  $[0, 10]$  by  $[0, 10]$ .

We want to use the same line but change the window to make it look like Figure 2 (where the  $x$ -interval is given) or Figure 3 (where the  $y$ -interval is given).

For Figure 2, fill in the  $y$ -interval,  $[y_{\min}, y_{\max}]$ , below the figure.

For Figure 3, fill in the  $x$ -interval,  $[x_{\min}, x_{\max}]$ , below the figure. [Close is good enough.]

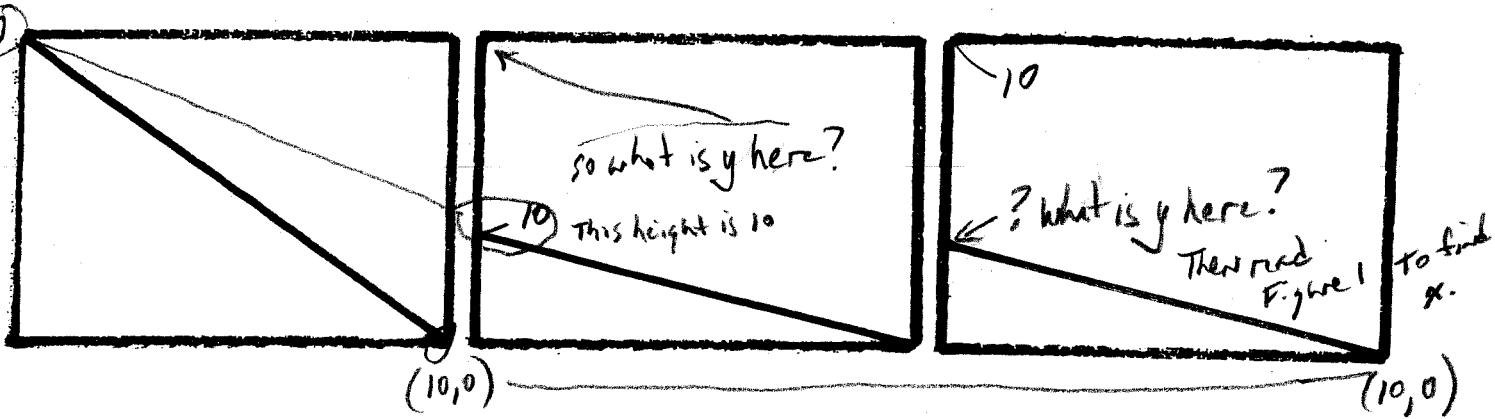


Figure 1:  $[0, 10]$  by  $[0, 10]$

Figure 2:  $[0, 10]$  by .....

Figure 3: ..... by  $[0, 10]$

7. Suppose the graph of  $f$  includes the point  $(3, 12)$ . Find a point on the graph of

a)  $f(x+5)$   $(-2, 12)$

*left 5*

b)  $f(x) - 4$   $(3, 8)$

*down 4*

c)  $f(3x)$   $(1, 12)$

d)  $f(x)/2$   $(3, 6)$

e)  $f^{-1}(x)$   $(12, 3)$

*p. 96 bottom, p. 97*

*Table page 87*

8. (6 pts) Suppose you have a graph in the window  $[0, 10]$  by  $[0, 10]$ .

a) If you change the window to  $[0, 10]$  by  $[0, 20]$  it will appear [pick one] taller shorter closer to the  $y$ -axis further from the  $y$ -axis

b) If you change the window to  $[0, 5]$  by  $[0, 10]$  it will appear [pick one] taller shorter closer to the  $y$ -axis further from the  $y$ -axis

*p. 69 Table*

9. Here is the graph of  $y = x^4(1-x)^6$  in a certain window. Find the window.

[Approximate answers are good enough.]

The  $x$ -interval has  $x_{\min} =$                       and  $x_{\max} =$

The  $y$ -interval has  $y_{\min} =$                       and  $y_{\max} =$



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Figure 6

10. There are four ways to solve equations. Inverse-Reverse (IR), Zero Product Rule (ZPR), Quadratic Formula (QF), and Guess and Check (GC). For each of the following name the **algebraic method best suited** to solving the equation. If and only if none of the three algebraic methods work, pick GC. Do NOT solve these! Name the method (abbreviations are ok)!

a)  $(x - 2)(x - 5) - 17 = 0$ .

b)  $x(\log 9) + 5x = 19$

p56 Ex 2

c)  $(x^2 - 5)(x - 2) + (x - 2)(x + 4) = 0$

p60 Ex 9

d)  $x^2 + 3\sqrt{x} - 5 = 0$

p.61 Ex 10C

e)  $x\sqrt{x+2} = 20$

f)  $(x - 2)^3 - 14 = 0$ .

p56

11. Solve for  $x$ :  $(x - 2)^2(x + 3) + 5x^2 - 4x = 2$ . Concisely say or show how you did it.

Problem #10 was a hint!

This is a cubic.

G&C!

Do no algebra except put 2 on the left

Do not multiply it out.

\*\*\*\* Reading and Writing Mathematics. The remaining problems ask you to use symbolism properly.

12. Methods can be stated as formulas, identities, or as theorems that relate equations. State, symbolically, as in Section 1.4 on writing mathematics, the requested **methods** [Use no regular English words. Use mathematical symbols. Do not give examples. Give a general method in symbols.]

a) How do you find the circumference of a circle?  $C = 2\pi r$  or  $C = \pi d$

b) How do you divide a number by a fraction (and get something simpler)?

$$\frac{a}{\left(\frac{b}{c}\right)} = \frac{ac}{b}$$

13. Here is a theorem:  $|x - c| < d$  iff  $c - d < x < c + d$ . Use it to rewrite " $|x + 2| < 1$ ."

↑ minus

↑ careful!

$$+2 = -(-2)$$

14. Here is a definition, just for this problem. Read it and use it to do the two parts.

Definition of #:  $x \# y = 3x + y$  if  $x \geq 3$  and  $x \# y = 4y - x$  if  $x < 3$ .

a) Find  $2 \# 5$

→  $2 < 3$  so use

b) Solve for  $x$ :  $4 \# x = 6$

$4 > 3$  so use the first alternative

$$3(4) + x = 6$$

$$x = -6$$