

**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 calculator problems. To solve numerical problems guess-and-check is legal unless you are requested to solve them "algebraically."

1. Short answer

a) Solve for  $p$ :  $x^2x^8 = x^4(x^p)$  for all  $x$ .

b) Give the axis of symmetry of the graph of  $y = 5x^2 - dx + 9$

c) What is the maximum number of local extrema that a polynomial of degree  $k$  can have?

e) Give the end-behavior model of  $y = \frac{x - 9}{5 - 2x - 3x^2}$ .

e) Complete the theorem: Let  $n$  be a positive integer. The equation " $x^n = c$ " has no real-valued solutions iff ...

Problem	points	score
1	15	
2	8	
3	10	
4	10	
5	7	
6	10	
7	10	
8	10	
9	10	
10	10	
total	100	

2. True or false? No reason required.

- a) T F The equation of a line " $y = mx + b$ " has two parameters.
- b) T F The area of a circle is proportional to its radius.
- c) T F  $x = c$  iff  $x^2 = c^2$ .
- d) T F A fourth-degree polynomial (with an " $ax^4$ " term) can have exactly two local maxima.

3. A point is on the line  $y = 2x$ . Its distance from the  $y$ -axis is the same as its distance from  $(4, 3)$ . SET UP one equation with one unknown that could be used to solve for the  $x$ -value of the point. [You need not actually solve it if your equation is right.]

4. Solve algebraically:  $x = 3 + \sqrt{2x + 2}$

5. Solve for  $y$ :  $3x^2 + 6xy + 2y^2 - 5x = 40$ .

6. The graph of a quadratic goes through these three points:  $(2, 0)$ ,  $(7, 0)$  and  $(0, 13)$ .  
Find the quadratic in factored form.

7. The formula for the volume of a cubical box is  $V = s^3$ , where  $s$  is the length of one side. The formula for the surface area of a cubical box is  $A = 6s^2$ .

a) Find the formula for the volume of a cubical box in terms of its surface area (There will be no "s" in the formula.)

b) Then simplify as much as appropriate.

c) Then use your calculator to convert the constant to a decimal number so the volume is written as a constant times some power of  $A$ . What is the decimal-value of the constant?

8. A function,  $g$ , satisfies:  $g(0.4) = 0.971$ ,  $g(0.6) = 0.772$ ,  $g(0.8) = 0.523$ , and  $g(1.0) = 0.224$ . Use linear interpolation to approximate the solution to  $g(x) = 0.57$ . Do it in two stages.

a) Determine the best approximating line. b) Solve for  $x$  [Get at least 3 significant digits right.]

9. A stock went up for four years and then dropped 30% in the fifth year. Nevertheless, it was still up 80% over those five years.

a) What was the average annual change over those five years?

b) How much was it up during the first four years?

10. A rectangle has one side 10. (See the figure)

The other side is unknown, but the diagonal is equal to 38% of the rectangle's perimeter. SET UP one equation with one unknown which could be solved for the other side. [You not bother to actually solve it if your equation is correct.]

