

**** SHOW WORK **** (except on short-answer problems).

Algebraic problems without clear supporting work will receive **little or no credit**.

1. (Short answer problems.)

a) Find the x -value of the vertex of $y = kx^2 + 7 + 3dx$.

b) What is the largest number of local maxima a polynomial of degree 4 can have?

c) $(x - h)^2 + (y - k)^2 = r^2$ is the equation of a circle. How many parameters does it have?

2. a) Solve for x : $x^{-1.7} = 50$

b) Let n be a positive integer and $k \neq 0$. Under what conditions on n and k does the equation " $x^n = k$ " have exactly two real-valued solutions?

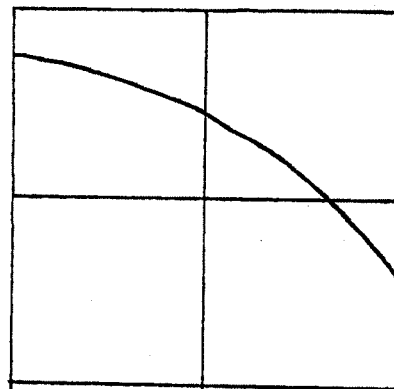
Problem	points	score
1	9	
2	8	
3	6	
4	8	
5	5	
6	12	
7	10	
8	6	
9	12	
10	12	
11	12	
total	100	

3. Solve algebraically: $\frac{x^4 x^5}{x^3} = 45$

4. If Item B costs 35 percent more than Item A, how much less does Item A cost than Item B?

5. Here is a graph of $y = f(x)$ in the window $[-100, 100]$ by $[-20, 20]$. Notice the window and its scale.

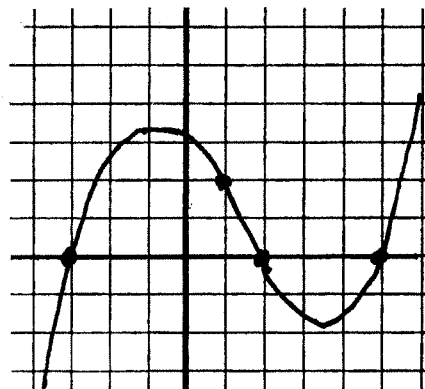
Use the graph to estimate $f^{-1}(-5)$.
 [Reasonably close is good enough.]



6. Here is a graph of a cubic polynomial $P(x)$. Grid lines are one unit apart. Algebraically find $P(x)$ with this graph that goes through the four emphasized points, including $(1, 2)$.

After you show your work below, fill in the answer here:

$$P(x) =$$



7. Solve algebraically: $\sqrt{2x + 7} = x - 4$. [Show work or expect no credit.]

8. Solve algebraically for b in this equation: $a^2 + 4ab + 3b^2 + a = 14$.
[Once you have it correct, do not bother to "simplify" it.]

9. Silver has density 10.5 grams per cubic centimeter. Gold has density 19.3 grams per cubic centimeter. If 15 cubic centimeters of an alloy (mixture) of gold and silver weigh 200 grams, how many cubic centimeters of the alloy are gold? [Algebraically SET UP one equation with one unknown that can be solved to find the answer, and then solve it.]

10. Consider the graph of " $y = 1/x$." Let $0 < a < b$. The vertical lines $x = a$ and $x = b$ intersect the graph at two points. Find the point-slope form of the equation of the line through those two points. [Simplify the slope, but leave the overall equation in point-slope form.]

11. Suppose sales of the app iBozeman went up 120 percent over two years.

a) What was the average change per year over those two years?

b) If sales went up 55 percent the first year, how much did they go up the second?
