

1. Solve the equation $x^2 + 4x - 21 = 0$ in two different ways:

part a (10 pts) Factoring

part b (10 pts) Completing the square

2. Solve the absolute value inequality. Give your answer in set-builder *and* interval notation:

part a (10 pts) $|2x - 7| \leq 5$

part b (10 pts) $|3x - 2| > 5$

part c (5 pts) $|7x + 2| \geq -4$

part d (5 pts) $|2x - 7| < -4$

3. (10 pts) What is the domain of $f(x) = \sqrt{\frac{x^2 + 4x - 21}{x + 2}}$?

4. (10 pts) What is the domain of $\log_5(x^2 + 4x - 21)$?

5. (10 pts) Form a polynomial (in factored form) that will have *real* coefficients after expanding (which you shouldn't bother to do!) that has the following zeros and respective multiplicities. What is its degree?

$x = 3$, multiplicity = 2 ;

$x = -5$, multiplicity = 1 ; and,

$x = 3 + 2i$, multiplicity = 1.

6. Let $f(x) = 4x^4 - 16x^3 - 31x^2 + 94x - 195$.

part a (10 pts) Use synthetic division to determine if $x + 3$ is a factor of f .

Interpret your work by filling in the *quotient* and *remainder* in the statement $4x^4 - 16x^3 - 31x^2 + 94x - 195 = (x + 3) \cdot \text{quotient} + \text{remainder}$.

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Hopefully, your remainder is zero. It's *how* you get it and how you interpret it that matter to me.

part b (10 pts) Show that $x = 5$ is a root of f by dividing your *quotient* in **part a** by $x - 5$. The quotient from **part a** is the so-called *depressed polynomial*, of degree 3. This question, in itself, ought to give you a very clear idea of what your conclusion ought to have been in part a.

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part c (10 pts) Compute the discriminant of $4x^2 - 8x + 13$. Then find the two nonreal roots of $4x^2 - 8x + 13$, by any method (short of copying from someone else). This question *should* give you a very good idea of how things went for you, above.

part d (10 pts) Write f as the product of linear factors. You can still earn the **part d** points without any of **a**, **b**, or **c** by *making up* plausible answers and incorporating them into the answer to this question. It should have 2 real and 2 nonreal zeros represented by the factors.

7. (10 pts) Determine a , r and n for the finite geometric series $3 + 6 + 12 + \dots + 1536$

Use a , r , and n to determine the sum by the formula $\sum_{k=1}^n a \cdot r^{k-1} = a \left(\frac{1-r^n}{1-r} \right)$.

8. (10 pts) Use Pascal's Triangle (Binomial Theorem) to expand the binomial power $(x-2)^6$.

Expanding without using a recognizable version of this technique will earn at most 2 points.

9. (10 pts) Graph $g(x) = -\sqrt{x+2} + 5$ using the techniques of shifting and reflecting. Start with the graph of the basic function $f(x) = \sqrt{x}$ and show all stages. In the final graph, indicate (label as ordered pairs) the x - and y - intercepts.

10. (15 pts) Solve the equation $A_0 e^{5300k} = \frac{1}{2} A_0$ for the decay rate, k .

11. (10 pts) Suppose the half-life of Carbon-14 is 5300 years. (It isn't, but just suppose...). How old is a sample of wood from a fire pit if only 30% of the original amount of Carbon-14 remains?

12. (15 pts) Solve the system of linear equations:

$$3x + 2y = 6$$

$$x - 3y = 12$$

BONUS

- 1) The population of a bee colony in 2008 is 800 bees. The population of that colony grows to 900 in 2012. The population is a function of time in the exponential model $P(t) = P_0 e^{kt}$ where $t = 0$ represents the year 2008.
- a) Define the variables given this information and identify the two ordered pairs to use as points.
- b) Graphing
- Label the axes appropriately for the context of the problem.
 - Graph (plot) the 2 points. (*Just* the two points, in correct (relative) position. We will finish the graph later.)
- c)
- Find the rate of growth. Show your work. Round to 4 decimal places.
 - Find the equation of the exponential function which models the situation.

- d) Graph the equation of the curve on the same graph as the two points in part b. (I'd *rather* you just did the graph of the thing (correct *shape*) and then stuck the two points on it in relatively correct position.)
- e) Use your equation (with k rounded to 4 places) to find the estimated population in 2017. Show your work.
- f) Use the equation to calculate in what year the population will reach 1000 if the growth continues at this same rate. Show your work.
- g) What would be the effect to the population if the rate had the opposite sign? Use complete sentences in your explanation.
- h) List two real-life factors which may affect the population such that this model would not prove valid. Use complete sentences.