

Answer on lined paper. Show work.

Rational exponents and radicals

1. Write $\sqrt[6]{x} \cdot \sqrt{x}$ as a single term with a rational exponent.
2. True or false: $(27^{\frac{2}{9}})$ can be written as the equivalent radical expression $\sqrt[3]{9}$
3. For $x \neq 0$, which expressions are equivalent to one divided by the sixth root of x ?

$$\text{I. } \frac{\sqrt[6]{x}}{\sqrt[3]{x}} \quad \text{II. } \frac{x^{\frac{1}{6}}}{x^{\frac{1}{3}}} \quad \text{III. } x^{-\frac{1}{6}}$$

Polynomial algebra procedures

4. Simplify $(x - 3)(-2x^2 + 5x + 1)$
5. Is 3 a solution to the equation $f(x) = x^3 - 2x - 20$?
6. Given $r(x) = x^3 - 4x^2 + 4x - 6$, find the value of $r(2)$.
What does your answer tell you about $x - 2$ as a factor of $r(x)$? Explain.
7. A manufacturing company has developed a cost model,
 $C(x) = 0.15x^3 + 0.01x^2 + 2x + 120$, where x is the number of items sold, in thousands.
The sales price can be modeled by $S(x) = 30 - 0.01x$. Therefore, revenue is modeled
by $R(x) = x \cdot S(x)$.

The company's profit, $P(x) = R(x) - C(x)$, could be modeled by what polynomial?

Graphing calculator solutions

8. Given $f(x) = 3|x| - 1$ and $g(x) = 0.03x^3 - x + 1$. Graph the two functions and make a quick sketch. Find the two solutions for the equation $f(x) = g(x)$, stating them as ordered pairs rounded to the nearest hundredth.

Function transformations

9. Given the parent function $p(x) = \cos x$, which phrase best describes the transformation used to obtain the graph of $g(x) = \cos(x + a) - b$, if a and b are positive constants?
 - (1) right a units, up b units
 - (2) right a units, down b units
 - (3) left a units, up b units
 - (4) left a units, down b units

Exponential models, base change

10. A student studying public policy created a model for the population of Detroit, where the population decreased 25% over a decade. He used the model $P = 714(0.75)^d$, where P is the population, in thousands, d decades after 2010. Another student, Suzanne, wants to use a model that would predict the population after y years. Suzanne's model is best represented by
- (1) $P = 714(0.6500)^y$ (3) $P = 714(0.9716)^y$
(2) $P = 714(0.8500)^y$ (4) $P = 714(0.9750)^y$
11. A radioactive substance has a mass of 140 g at 3 p.m. and 100 g at 8 p.m. Write an equation in the form $A = A_0 \left(\frac{1}{2}\right)^{\frac{t}{h}}$ that models this situation, where h is the constant representing the number of hours in the half-life, A_0 is the initial mass, and A is the mass t hours after 3 p.m.

Using this equation, solve for h , to the *nearest ten thousandth*.

Determine when the mass of the radioactive substance will be 40 g. Round your answer to the nearest tenth of an hour.

Logarithms

12. What is the $\log_3 27$?
13. Simplify $\ln 18 - \ln 2$
14. What is the exact solution to $8(2^{x+3}) = 48$?

Imaginary numbers

15. Simplify $9i + (2i)^3$
16. Use the quadratic formula to find the solution to the equation $4x^2 + 98 = 0$.
17. The expression $6xi^3(-4xi + 5)$ is equivalent to...