

Answer on lined paper. Show work.

Rational exponents and radicals

1. Simplify the expression $\sqrt[3]{x} \cdot \sqrt[3]{x^5}$
2. If $p(x) = ab^x$ and $r(x) = cd^x$, then $p(x) \cdot r(x)$ equals
 - (1) $ac(b+d)^x$
 - (2) $ac(b+d)^{2x}$
 - (3) $ac(bd)^x$
 - (4) $ac(bd)^{x^2}$
3. Simplify the expression $\left(\frac{s^{\frac{2}{3}}}{s^2}\right)^{-\frac{1}{2}}$ to one with positive integer exponents and radicals.

Logarithms

4. What is the inverse of the function $y = \ln x$?

Imaginary numbers

5. Use the quadratic formula to find the solution to the equation $2x^2 - 4x + 7 = 0$.
6. Simplify the expression $(4 + 3i)^2$.

Polynomial algebra procedures

7. If $(x - 3)$ is a factor of $f(x) = (x - 3)(ax^2 + bx + c)$, then what is the value of $f(3)$?
8. When $g(x)$ is divided by $x + 4$, the remainder is 0. Given $g(x) = x^4 + 3x^3 - 6x^2 - 6x - 8$. Write down the value of $g(-4)$?

("Write down" means by inspection. How can you answer this without calculation?)
9. The velocity of a tidal wave, v , in hundreds of miles per hour, can be modeled by the equation $v = 5 - \sqrt{t}$, where t represents the time from its origin in hours. Algebraically determine the time when $v = 0$.

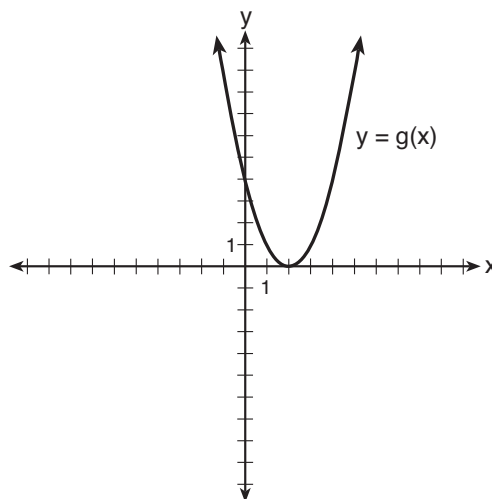
How much faster was the tidal wave traveling after 1 hour than 3 hours, to the *nearest mile per hour*? Justify your answer.

Function transformations

10. Relative to the graph of $y = 3 \sin x$, what is the shift of the graph of $y = 3 \sin\left(x - \frac{\pi}{3}\right)$?

Graphing calculator solutions

11. When $g(x) = \frac{2}{x+2}$ and $h(x) = \log(x+1) + 3$ are graphed on the same set of axes, which coordinates best approximate their point of intersection?
12. What is the solution to the system of equations $y = 3x - 2$ and $y = g(x)$ where $g(x)$ is defined by the function below?

**Exponential models, base change**

13. A rabbit population doubles every 4 weeks. There are currently five rabbits in a restricted area. If t represents the time, in weeks, and $P(t)$ is the population of rabbits with respect to time, about how many rabbits will there be in 98 days?
14. Pedro and Bobby each own an ant farm. Pedro starts with 100 ants and says his farm is growing exponentially at a rate of 15% per month. Bobby starts with 350 ants and says his farm is steadily *decreasing* by 5 ants per month.
- Assuming both boys are accurate in describing the population of their ant farms, after how many months will they both have approximately the same number of ants?
15. According to a pricing website, Android phones lose 58% of their cash value over 1.5 years. Which expression can be used to estimate the value of a \$300 Android phone in 1.5 years?
- (1) $300e^{-0.87}$ (3) $300e^{-0.58}$
(2) $300e^{-0.63}$ (4) $300e^{-0.42}$