Problem 1. Rationalize the denominator of the fraction $\frac{14}{3+\sqrt{2}}$.

Problem 2. Given $g(x) = 5x^2 - 2x + 3$ and $h(x) = \sqrt{9x+7}$, find the value of $(g \circ h)(2)$.

Problem 3. Find the sum below, and write your answer in simplified form.

$$\frac{x+2a-3}{x+a} + \frac{x+6}{2x}.$$

Problem 4. Factor and reduce to simplest form the expression $\frac{6x^2+11xy-10y^2}{3x^2+10xy-8y^2}$.

Problem 5. Simplify completely the expression $\frac{\left(x^{-4}y^{2/5}\right)^{-3/4}}{x^{2/3}y^{-5/6}}$.

Problem 6. Perform the indicated operation and simplify your answer:

$$\left(3ab\sqrt[5]{16a^4b^2}\right)\left(8b^7\sqrt[5]{2ab^3}\right).$$

Problem 7. Find the sum of the solutions of the equation: $5(x-7)^2 - 13(x-7) - 6 = 0$.

Problem 8. A radioactive element decays according to the model $y = 80e^{-0.21t}$, where t is in hours. Use natural logarithms to find the half-life of the element.

Problem 9. Find the point (x, y) which satisfies both equations below. What is the value of $x+y$?

$$\begin{cases} -3 = 3x - 5y \\ 12 = -2x + 4y \end{cases}$$

Problem 10. Two investments are made totaling \$10,000. In one year these investments yield \$650 in simple interest. Part of the \$10,000 is invested at $5\frac{1}{2}\%$, and the rest at $6\frac{3}{4}\%$. How much more money is invested at $6\frac{3}{4}\%$?

Problem 11. Let $y = f(x)$ be a linear function that satisfies $f(3) = 5$ and $f(6) = 9$. Find the slope of the line.

Problem 12. Write a slope-intercept form of the equation of a line with slope 5 that goes through the point $(-2, 3)$.

Problem 13. Find the vertex of the parabola $f(x) = 7px^2 + 28px + 11p$.

Problem 14. Let $f(x) = \sqrt{x}$. Find the expression of a function $g(x)$ whose graph is that of f shifted to the left 2 units, reflected about the x axis, and then shifted up by 7 units.

Problem 15. Which one of the following is an incorrect algebraic statement?

$$7(x+1)^3 \neq (7x+7)^3 \qquad \frac{1}{3x^8} = \frac{1}{3}x^{-8} \qquad (x+8)^2 = x^2 + 64$$

Problem 16. Find the domain of the function

$$f(x) = \frac{\sqrt{x+2}}{x-5}.$$

Problem 17. Find $f(0)$ for the piecewise function given by

$$f(x) = \begin{cases} x+8 & \text{for } x \geq 3 \\ x-4 & \text{for } x < 3 \end{cases}$$

Problem 18. Find the x–intercept(s) of the following function, if any exist.

$$f(x) = \frac{6x^2 - 7x - 5}{4x^2 - 12x - 7}.$$

Problem 19. Use the quadratic formula to solve the equation $x^2 - 6x + 2 = 0$. Simplify as much as possible.

Problem 20. Solve the following equation:

$$\log_2(x+2) + \log_2(x+6) = 5.$$

Problem 21. Simplify the following expression

$$\frac{\ln\left(e^{x+2}\right) - \log_7 1}{\log_4 256}.$$

Problem 22. Solve the equation $8 \ln\left(\frac{1}{2}x\right) = 72$.

Problem 23. Does the following table represent an exponential function? If so, write a corresponding expression:

x	-2	-1	0	1	2	3	4
$f(x)$	0.0125	0.05	0.2	0.8	3.2	12.8	51.2

Problem 24. A real estate developer opens a new subdivision with a certain number of houses. Each year, 12 new houses are built in the subdivision. The number of houses in the subdivision is a linear function of the years since the subdivision opened. Seven years after opening, there were 109 houses. Eleven years after opening, there were 157 houses.

How many houses were there at the beginning? What are the units of the slope of the line?