

1. **(2 points)** Write the condition  $x \leq 4$  as an interval.

This interval includes 4 and everything below it, so it is written as  $(-\infty, 4]$ .

2. **(3 points)** Determine the value (writing as an integer or a fraction as appropriate) of  $9^{-3/2}$ .

$$9^{-3/2} = (9^{1/2})^{-3} = \sqrt{9}^{-3} = 3^{-3} = \frac{1}{27}.$$

3. **(3 points)** Simplify the expression  $\frac{x^4yz^2}{(xyz^3)^2}$ .

$$\frac{x^4yz^2}{(xyz^3)^2} = \frac{x^4yz^2}{x^2y^2z^6} = \frac{x^2}{yz^4}. \text{ This could also be written as } x^2y^{-1}z^{-4} \text{ if preferred.}$$

4. **(4 points)** Simplify the rational expression  $\frac{1}{x+2} - \frac{6}{x-5}$ .

$$\begin{aligned} \frac{1}{x+2} - \frac{6}{x-5} &= \frac{x-5}{(x+2)(x-5)} - \frac{6(x+2)}{(x+2)(x-5)} \\ &= \frac{x-5}{x^2-3x-10} - \frac{6x+12}{x^2-3x-10} \\ &= \frac{(x-5) - (6x+12)}{x^2-3x-10} = \frac{-5x-17}{x^2-3x-10} \end{aligned}$$

5. **(4 points)** Using whatever method you wish, find the real solution or solutions to the equation  $3x^2 - 5x + 4 = x + 2$ .

Subtracting  $x + 2$  from both sides, we get the equation  $3x^2 - 6x + 2 = 0$ , which we can solve with the quadratic formula (with the specific coefficients  $a = 3$ ,  $b = -6$ , and  $c = 2$ ):

$$x = \frac{6 \pm \sqrt{36 - 24}}{6} = \frac{6 \pm \sqrt{12}}{6} = 1 \pm \frac{\sqrt{3}}{3}.$$

6. **(4 points)** A boat travels at 12 miles per hour when going upstream, and 18 miles per hour when going downstream. A two-hour trip goes up the river and then back down the river to its starting point. How far did it go up the river? Let us build a table to contain all the information we have, letting  $x$  equal the distance traveled up (and back down) the river.

	Time (in hours)	Speed (in mph)	Distance (in miles)
Upstream	$\frac{x}{12}$	12	$x$
Downstream	$\frac{x}{18}$	18	$x$
Total trip	2		$2x$

Note then that above we also calculated the travel time for each leg as the ratio of distance to speed. Since the total travel time is 2 hours, it must then be the case that

$$\frac{x}{12} + \frac{x}{18} = 2$$

which simplifies to  $\frac{5}{36}x = 2$ , so  $x = \frac{72}{5}$  miles (or 14.4, in decimal form).