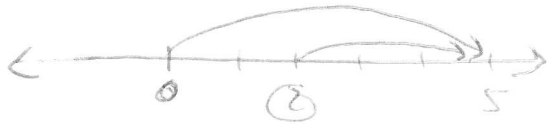
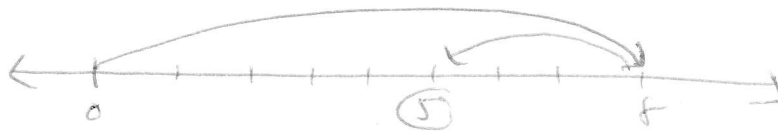


1. (5 points each) Draw number-line diagrams to represent each of the following calculations.

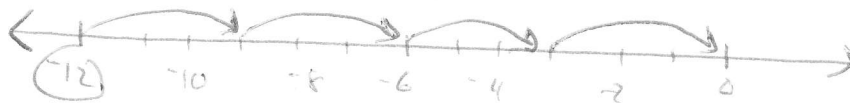
(a) $5 - 3 = 2$



(b) $8 + (-3) = 5$



(c) $(-4) \cdot 3 = -12$



2. (10 points) Order these rational numbers using the $<$ sign:

$$\frac{-8}{3}, 0, \frac{4}{5}, \frac{5}{4}, -4, \frac{-25}{9}$$

$$-4 < \frac{-25}{9} < \frac{-8}{3} < 0 < \frac{4}{5} < \frac{5}{4}$$

$$\frac{-8}{3} = \frac{-24}{9} > \frac{-25}{9}$$

$$\frac{4}{5} < 1 < \frac{5}{4}$$

3. (5 points each) You decided not to become a teacher and instead joined NASA to travel on board a space shuttle to the newest planet, Obamatron 44. All of the clocks on the space ship are set on military time, ie. 24-hour clocks. Perform the indicated calculations on the space ship so you have practiced military time operations and will never be late.

(a) $17 +_{24} 9$

$$17 +_{24} 9 = 26 \text{ mod } 24 = 2$$

(b) $12 -_{24} 21$

$$12 -_{24} 21 = 9 \text{ mod } 24 = 15$$

(c) $4 \times_{24} 13$

$$4 \times_{24} 13 = 52 \text{ mod } 24 = 4$$

(d) $21 \div_{24} 7$

Undefined since $\gcd(21, 24) = 3 \neq 1$, there will not be a unique c s.t. $7 \times_{24} c = 21$.

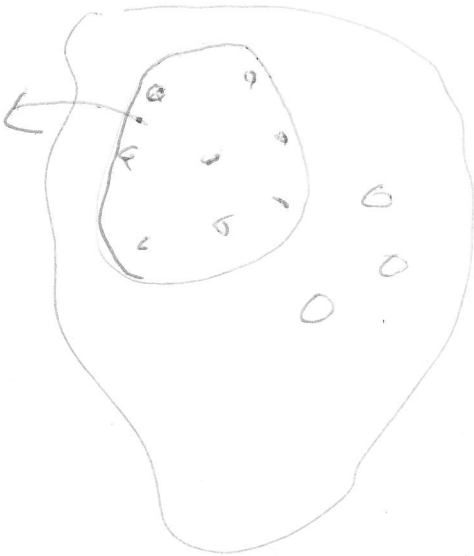
for example $c = 3$ or $c = 17$

$$\gcd(24, 7) = 1 \text{ so}$$

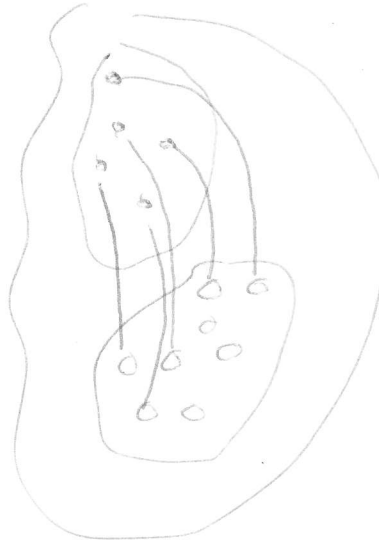
$$21 \div_{24} 7 = 3$$

4. (10 points) Using colored counters, explain the difference between the equations $5 - 8 = -3$ and $5 + (-8) = -3$. Be sure to label which diagram corresponds to which equation and write a paragraph discussing the differences.

$$\underline{5 - 8 = -3}$$



$$\underline{5 + (-8) = -3}$$



Key
 ⊕ = +
 ⊖ = -

5. (3 points each) Answer true or false to the following questions. You must write the complete word to receive credit for the problem. You do not need to show your work on this problem.

(a) The fractions $\frac{10204}{3}$ and $\frac{20406}{6}$ are equivalent.

False

(b) The integers are closed under addition, subtraction, multiplication, and division.

False

(c) If $\frac{a}{b}, \frac{c}{d} \in \mathbb{Q}$ then $|\frac{a}{b} - \frac{c}{d}| = |\frac{a}{b}| - |\frac{c}{d}|$.

False

(d) $\frac{1}{2} + \frac{3}{5} = \frac{4}{7}$

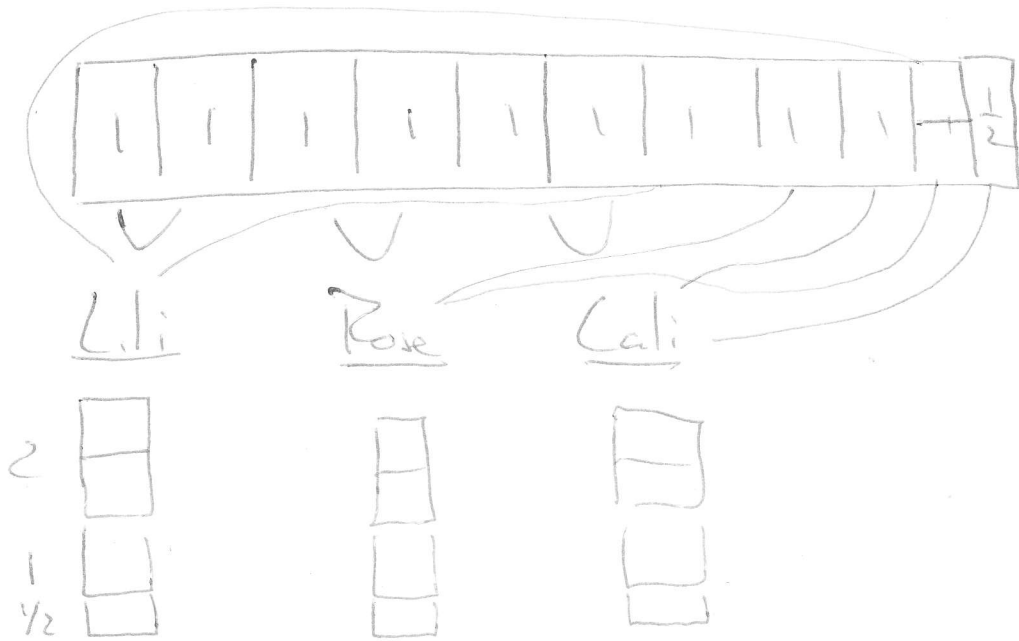
False

(e) If $x, y \in \mathbb{Q}$ and they are multiplicative inverses then $x \times y = 0$.

False

6. (10 points) Using any conceptual model you like, solve the following problem in Q. Solving without using a conceptual model will receive minimal credit.

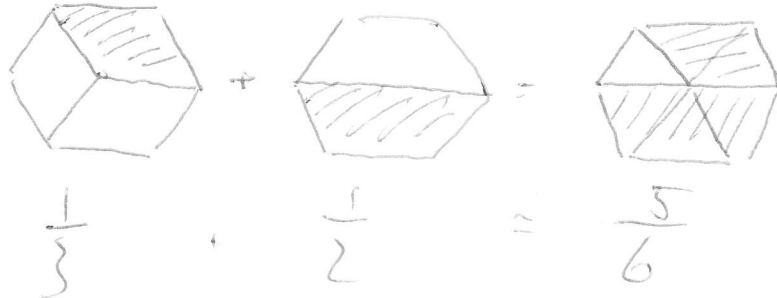
Lili, Rose, and Cali are going backpacking for a weekend and bring $10\frac{1}{2}$ pounds of nuts and granola to carry. They want to share the load equally. How many pounds of food should each person carry?



$$2 + 1 + \frac{1}{2} = 3\frac{1}{2}$$

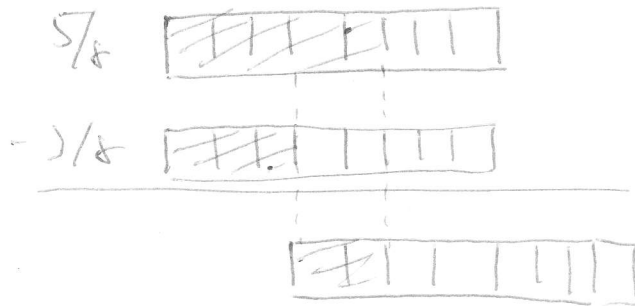
7. (5 points each) Compute the following calculations in \mathbb{Q} using the desired model.

(a) Use the colored regions area model to compute $\frac{1}{3} + \frac{1}{2}$.



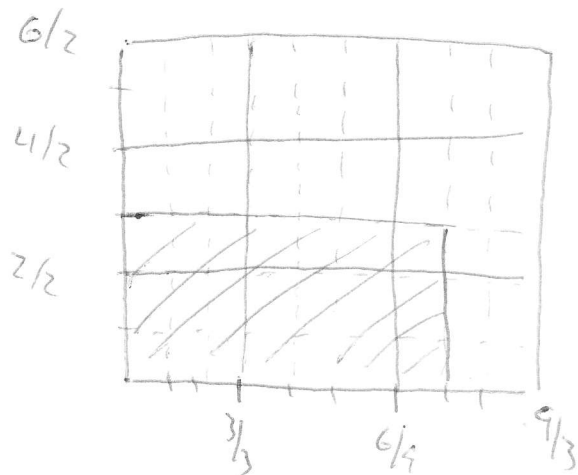
unit =

(b) Use the fraction strip model to compute $\frac{5}{8} - \frac{3}{8}$.



unit =

8. (10 points) Using the rectangular area model for multiplication in \mathbb{Q} , solve $\frac{3}{2} \times \frac{7}{3}$.



$$\frac{3}{2} \times \frac{7}{3} = \frac{21}{6}$$