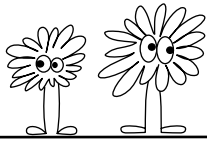
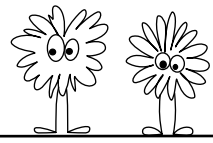


FRACTION NINJA BOOTCAMP LEVEL 2





COMMON FACTORS



For each pair of numbers, find the greatest common factor.

24, 34 Factors of 24: 1, 2, 3, 4, 6, 8, 10, 12, 24
Factors of 34: 1, 2, 17, 34
 $\text{gcf}(24, 34) = 2$

56, 35 Factors of 56: 1, 2, 4, 7, 8, 14, 28, 56
Factors of 35: 1, 5, 7, 35
 $\text{gcf}(56, 35) = 7$

80, 55 Factors of 80: 1, 2, 4, 5, 8, 10, 16, 20, 40, 80
Factors of 55: 1, 5, 11, 55
 $\text{gcf}(80, 55) = 5$

60, 42 Factors of 60: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60
Factors of 42: 1, 2, 3, 6, 7, 14, 21, 42
 $\text{gcf}(60, 42) = 6$

90, 81 Factors of 90: 1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, 90
Factors of 81: 1, 3, 9, 27, 81
 $\text{gcf}(90, 81) = 9$

54, 84 Factors of 54: 1, 2, 3, 6, 9, 18, 27, 54
Factors of 84: 1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84
 $\text{gcf}(54, 84) = 6$

Here is a cool way to find the greatest common factor of two numbers by writing each number as a product of prime facts. (Prime numbers can't be broken down into a product of smaller numbers.)

To get the greatest common factor of 150 and 400, we

1. Write each number as a product of primes.

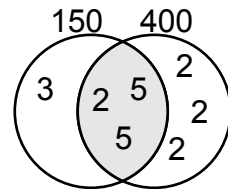
$$150 = 2 \times 3 \times 5 \times 5 \quad \text{and} \quad 400 = 2 \times 2 \times 2 \times 2 \times 5 \times 5$$

2. Find all the prime factors that were in common.

$$150 = \underline{2} \times 3 \times \underline{5} \times \underline{5} \quad \text{and} \quad 400 = \underline{2} \times 2 \times 2 \times 2 \times \underline{5} \times \underline{5}$$

3. Multiply out the prime factors that were in common to get the greatest common factor.

$$2 \times 5 \times 5 = 50 \text{ is the greatest common factor of 150 and 400.}$$

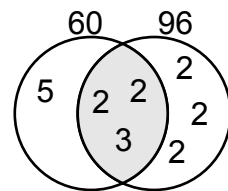


Let's try this trick to find the greatest common factor of 60 and 96.

1. $60 = 2 \times 2 \times 3 \times 5$ and $96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3$

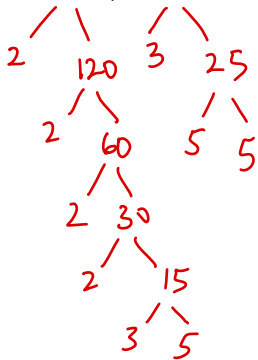
2. The factors in common are 2, 2, and 3.

3. The greatest common factor of 60 and 96 is $2 \times 2 \times 3 = 12$.



For each pair of numbers, find the greatest common factor. Can you do it using the technique described above?

240, 75

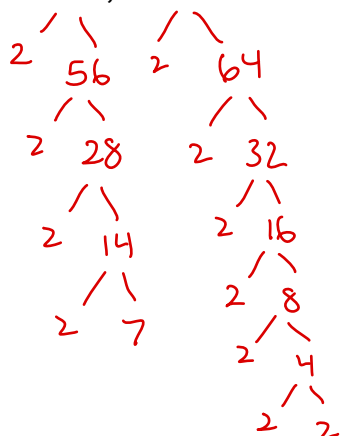


$$240 = 2 \times 2 \times 2 \times 2 \times \underline{3} \times \underline{5}$$

$$75 = \underline{3} \times \underline{5} \times 5$$

$$gcf(240, 75) = 3 \times 5 = 15.$$

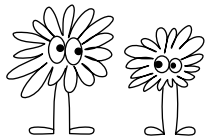
112, 128



$$112 = \underline{2} \times \underline{2} \times \underline{2} \times \underline{2} \times 7$$

$$128 = \underline{2} \times \underline{2} \times \underline{2} \times \underline{2} \times 2 \times 2 \times 2$$

$$gcf(112, 128) = 2 \times 2 \times 2 \times 2 = 16.$$



SIMPLIFYING FRACTIONS



$$\frac{8}{24} = \frac{1}{3}$$

$$\frac{40}{48} = \frac{5}{6}$$

$$\frac{21}{33} = \frac{7}{11}$$

$$\frac{54}{72} = \frac{3}{4}$$

$$\frac{66}{70} = \frac{33}{35}$$

$$\frac{56}{77} = \frac{8}{11}$$

$$\frac{32}{80} = \frac{2}{5}$$

$$\frac{25}{80} = \frac{5}{16}$$

$$\frac{8}{28} = \frac{2}{7}$$

$$\frac{20}{25} = \frac{4}{5}$$

$$\frac{12}{36} = \frac{1}{3}$$

$$\frac{15}{50} = \frac{3}{10}$$

$$\frac{13}{26} = \frac{1}{2}$$

$$\frac{6}{54} = \frac{1}{9}$$

$$\frac{18}{45} = \frac{2}{5}$$

$$\frac{64}{100} = \frac{16}{25}$$

$$\frac{45}{80} = \frac{9}{16}$$

$$\frac{15}{33} = \frac{5}{11}$$

$$\frac{36}{56} = \frac{9}{14}$$

$$\frac{12}{66} = \frac{2}{11}$$

$$\frac{24}{100} = \frac{6}{25}$$

$$\frac{22}{30} = \frac{11}{15}$$

$$\frac{48}{100} = \frac{12}{25}$$

$$\frac{16}{26} = \frac{8}{13}$$

$$\frac{62}{100} = \frac{31}{50}$$

$$\frac{28}{56} = \frac{1}{2}$$

$$\frac{36}{44} = \frac{9}{11}$$

$$\frac{72}{80} = \frac{9}{10}$$

$$\frac{6}{46} = \frac{3}{23}$$

$$\frac{60}{144} = \frac{5}{12}$$

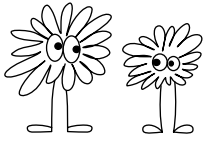
Simplified Fraction Maze

Travel through the maze by only visiting fractions that are in simplified form.

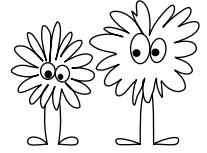
enter →

$\frac{4}{22}$	$\frac{9}{86}$	$\frac{17}{60}$	$\frac{3}{76}$	$\frac{13}{56}$	$\frac{9}{109}$	$\frac{7}{38}$	$\frac{4}{49}$	$\frac{59}{77}$	$\frac{3}{6}$	$\frac{63}{72}$	$\frac{4}{5}$	exit →
$\frac{50}{75}$	$\frac{2}{75}$	$\frac{14}{35}$	$\frac{2}{62}$	$\frac{65}{85}$	$\frac{70}{77}$	$\frac{10}{25}$	$\frac{4}{10}$	$\frac{12}{37}$	$\frac{52}{89}$	$\frac{49}{63}$	$\frac{7}{95}$	
$\frac{25}{45}$	$\frac{33}{100}$	$\frac{15}{26}$	$\frac{1}{96}$	$\frac{38}{53}$	$\frac{3}{8}$	$\frac{99}{101}$	$\frac{36}{61}$	$\frac{20}{30}$	$\frac{1}{2}$	$\frac{5}{156}$	$\frac{49}{92}$	
$\frac{16}{18}$	$\frac{26}{66}$	$\frac{19}{38}$	$\frac{13}{39}$	$\frac{20}{42}$	$\frac{90}{108}$	$\frac{15}{42}$	$\frac{42}{81}$	$\frac{3}{34}$	$\frac{21}{56}$	$\frac{55}{66}$	$\frac{45}{50}$	
$\frac{33}{43}$	$\frac{1}{11}$	$\frac{21}{26}$	$\frac{6}{11}$	$\frac{33}{45}$	$\frac{18}{33}$	$\frac{10}{18}$	$\frac{3}{33}$	$\frac{13}{59}$	$\frac{43}{70}$	$\frac{8}{83}$	$\frac{56}{75}$	
$\frac{4}{21}$	$\frac{15}{21}$	$\frac{33}{55}$	$\frac{45}{49}$	$\frac{42}{49}$	$\frac{20}{55}$	$\frac{12}{24}$	$\frac{9}{90}$	$\frac{5}{15}$	$\frac{65}{80}$	$\frac{36}{81}$	$\frac{28}{41}$	
$\frac{13}{15}$	$\frac{24}{44}$	$\frac{7}{69}$	$\frac{17}{31}$	$\frac{62}{66}$	$\frac{36}{54}$	$\frac{6}{8}$	$\frac{60}{75}$	$\frac{100}{110}$	$\frac{81}{90}$	$\frac{4}{28}$	$\frac{22}{25}$	
$\frac{3}{7}$	$\frac{88}{90}$	$\frac{3}{56}$	$\frac{32}{58}$	$\frac{42}{48}$	$\frac{8}{18}$	$\frac{21}{42}$	$\frac{28}{32}$	$\frac{11}{66}$	$\frac{6}{32}$	$\frac{16}{24}$	$\frac{3}{83}$	
$\frac{1}{5}$	$\frac{30}{42}$	$\frac{29}{34}$	$\frac{3}{14}$	$\frac{5}{18}$	$\frac{24}{43}$	$\frac{36}{49}$	$\frac{17}{99}$	$\frac{12}{67}$	$\frac{7}{76}$	$\frac{3}{5}$	$\frac{1}{99}$	

SCIENCE MAM



MIXED NUMBERS ON THE NUMBER LINE



Label each number on the number line.



$2\frac{1}{2}$

$5\frac{1}{3}$

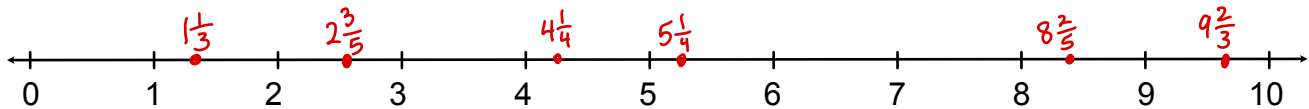
$1\frac{2}{5}$

$7\frac{5}{6}$

$4\frac{1}{2}$

$6\frac{3}{4}$

Label each number on the number line.



$4\frac{1}{4}$

$9\frac{2}{3}$

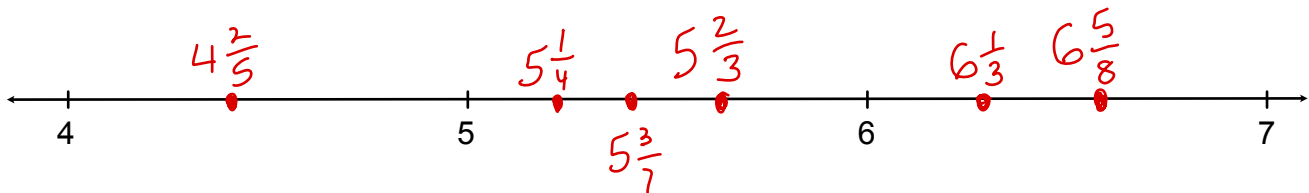
$2\frac{3}{5}$

$1\frac{1}{3}$

$8\frac{2}{5}$

$5\frac{1}{4}$

Label each number on the number line.



$5\frac{2}{3}$

$6\frac{5}{8}$

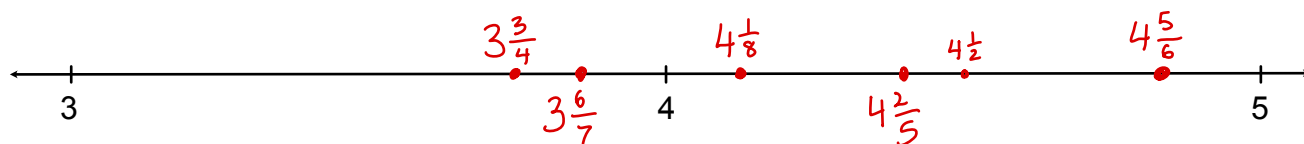
$4\frac{2}{5}$

$5\frac{1}{4}$

$6\frac{1}{3}$

$5\frac{3}{7}$

Label each number on the number line.



$$3\frac{6}{7}$$

$$4\frac{1}{8}$$

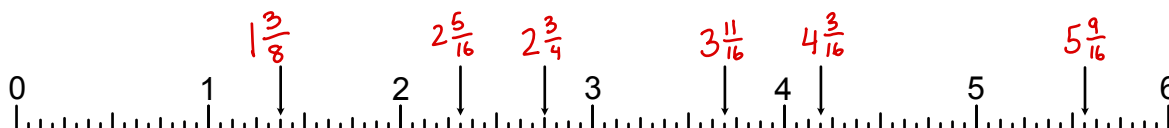
$$4\frac{5}{6}$$

$$4\frac{2}{5}$$

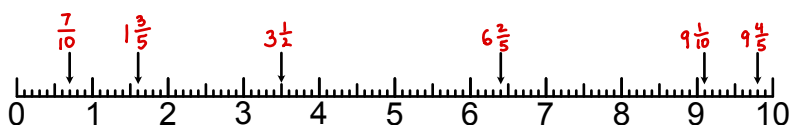
$$3\frac{3}{4}$$

$$4\frac{1}{2}$$

Inches are a unit of measure that usually gets broken up into 16 equal pieces. Below is a ruler measured in inches. Label each of the arrows with the appropriate fraction. (Be sure to simplify the fraction.)



Centimeters are a unit of measure that usually gets broken up into 10 equal pieces (called millimeters). Below is a 10-centimeter ruler that has locations marked with arrows. Label each arrow with the appropriate fraction. (Be sure to simplify the fraction.)



Do you prefer inches or centimeters as a unit of measurement? Explain why.

There is no wrong answer.

I prefer centimeters because they match our base-10 number system.

Calculations with decimals are easier with centimeters.

CONVERTING FRACTIONS TO MIXED NUMBERS

Convert each fraction to a mixed number.

$$\frac{25}{3} = 8\frac{1}{3}$$

$$\frac{29}{5} = 5\frac{4}{5}$$

$$\frac{66}{9} = 7\frac{3}{9} = 7\frac{1}{3}$$

$$\frac{43}{4} = 10\frac{3}{4}$$

$$\frac{51}{7} = 7\frac{2}{7}$$

$$\frac{37}{3} = 12\frac{1}{3}$$

$$\frac{60}{11} = 5\frac{5}{11}$$

$$\frac{60}{8} = 7\frac{4}{8} = 7\frac{1}{2}$$

$$\frac{93}{12} = 7\frac{9}{12} = 7\frac{3}{4}$$

$$\frac{81}{10} = 8\frac{1}{10}$$

$$\frac{19}{4} = 4\frac{3}{4}$$

$$\frac{31}{7} = 4\frac{3}{7}$$

Convert each fraction to a mixed number.

$$\frac{257}{3} = 85 \frac{2}{3}$$

$$\begin{array}{r} 85 \text{ R } 2 \\ 3 \overline{) 257} \\ \underline{\ominus 24} \\ 17 \\ \underline{\ominus 15} \\ 2 \end{array}$$

$$\frac{214}{7} = 30 \frac{4}{7}$$

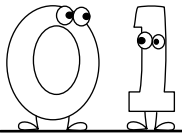
$$\begin{array}{r} 30 \text{ R } 4 \\ 7 \overline{) 214} \\ \underline{\ominus 21} \\ 04 \\ \underline{\ominus 0} \\ 4 \end{array}$$

$$\frac{3,434}{5} = 686 \frac{4}{5}$$

$$\begin{array}{r} 686 \text{ R } 4 \\ 5 \overline{) 3434} \\ \underline{\ominus 30} \\ 43 \\ \underline{\ominus 40} \\ 34 \\ \underline{\ominus 30} \\ 4 \end{array}$$

$$\frac{123,456,789}{10} = 12,345,678 \frac{9}{10}$$

Dividing by 10 shrinks
all the place values.



CONVERTING MIXED NUMBERS TO FRACTIONS

Convert each mixed number to a fraction.

$$11\frac{1}{2} = \frac{2 \times 11 + 1}{2} \\ = \frac{23}{2}.$$

$$20\frac{1}{3} = \frac{3 \times 20 + 1}{3} \\ = \frac{61}{3}.$$

$$6\frac{3}{5} = \frac{5 \times 6 + 3}{5} \\ = \frac{33}{5}.$$

$$8\frac{5}{6} = \frac{6 \times 8 + 5}{6} \\ = \frac{53}{6}.$$

$$12\frac{3}{7} = \frac{7 \times 12 + 3}{7} \\ = \frac{87}{7}.$$

$$15\frac{2}{3} = \frac{3 \times 15 + 2}{3} \\ = \frac{47}{3}.$$

$$5\frac{9}{10} = \frac{10 \times 5 + 9}{10} \\ = \frac{59}{10}.$$

$$9\frac{6}{11} = \frac{11 \times 9 + 6}{11} \\ = \frac{105}{11}.$$

$$1\frac{13}{20} = \frac{20 \times 1 + 13}{20} \\ = \frac{33}{20}.$$

$$6\frac{2}{7} = \frac{7 \times 6 + 2}{7} \\ = \frac{44}{7}.$$

$$4\frac{11}{12} = \frac{12 \times 4 + 11}{12} \\ = \frac{59}{12}.$$

$$20\frac{3}{4} = \frac{4 \times 20 + 3}{4} \\ = \frac{83}{4}.$$

Convert each mixed number to a fraction.

$$125\frac{2}{5} = \frac{5 \times 125 + 2}{5}$$
$$= \frac{627}{5}.$$

$$\begin{array}{r} 12 \\ 125 \\ \times 5 \\ \hline 625 \end{array}$$

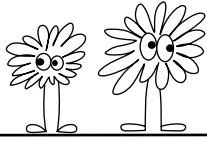
$$100\frac{7}{12} = \frac{12 \times 100 + 7}{12}$$
$$= \frac{1207}{12}.$$

$$136\frac{72}{73} = \frac{73 \times 136 + 72}{73}$$
$$= \frac{9,928 + 72}{73}$$
$$= \frac{10,000}{73}.$$

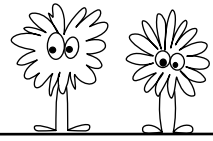
$$\begin{array}{r} 4 \\ 136 \\ \times 73 \\ \hline 408 \\ 9520 \\ \hline 9928 \end{array}$$

$$99\frac{23}{101} = \frac{101 \times 99 + 23}{101}$$
$$= \frac{9,999 + 23}{101}$$
$$= \frac{10,022}{101}.$$

$$\begin{array}{r} 101 \\ \times 99 \\ \hline 909 \\ 9090 \\ \hline 9999 \end{array}$$



COMPARING FRACTIONS



In each box, declare whether the fractions are "=", "<", or ">" to each other.

$$\frac{8}{24} < \frac{9}{25}$$

$$\frac{6}{32} < \frac{12}{16}$$

$$\frac{14}{50} < \frac{21}{60}$$

$$\frac{45}{54} = \frac{10}{12}$$

$$\frac{21}{35} = \frac{3}{5}$$

$$\frac{15}{35} < \frac{5}{11}$$

$$\frac{36}{88} > \frac{10}{25}$$

$$\frac{24}{36} = \frac{12}{18}$$

$$\frac{11}{28} > \frac{4}{14}$$

$$\frac{12}{24} = \frac{22}{44}$$

$$\frac{14}{22} < \frac{2}{3}$$

$$\frac{35}{40} < \frac{9}{10}$$

$$\frac{6}{11} = \frac{30}{55}$$

$$\frac{4}{48} < \frac{10}{80}$$

$$\frac{23}{29} < \frac{31}{41}$$

$$\frac{20}{120} > \frac{6}{40}$$

$$\frac{26}{52} = \frac{3}{6}$$

$$\frac{22}{24} < \frac{23}{25}$$

Place the following numbers in ascending order (from least to greatest).

$$\frac{3}{7} \quad \frac{5}{6} \quad \frac{1}{2} \quad \frac{2}{5} \quad \frac{4}{9} \quad \frac{5}{8}$$

$$\frac{2}{5} < \frac{3}{7} < \frac{4}{9} < \frac{1}{2} < \frac{5}{8} < \frac{5}{6}$$

Place the following numbers in ascending order (from least to greatest).

$$4\frac{11}{12} \quad 5\frac{1}{4} \quad 6\frac{4}{7} \quad 4\frac{1}{3} \quad 5\frac{5}{6} \quad 4\frac{3}{7}$$

$$4\frac{1}{3} < 4\frac{3}{7} < 4\frac{11}{12} < 5\frac{1}{4} < 5\frac{5}{6} < 6\frac{4}{7}$$

Place the following numbers in ascending order (from least to greatest).

$$\frac{43}{7} \quad \frac{15}{2} \quad \frac{35}{4} \quad \frac{27}{6} \quad \frac{77}{12} \quad \frac{53}{9}$$

$$\frac{27}{6} < \frac{53}{9} < \frac{43}{7} < \frac{77}{12} < \frac{15}{2} < \frac{35}{4}$$

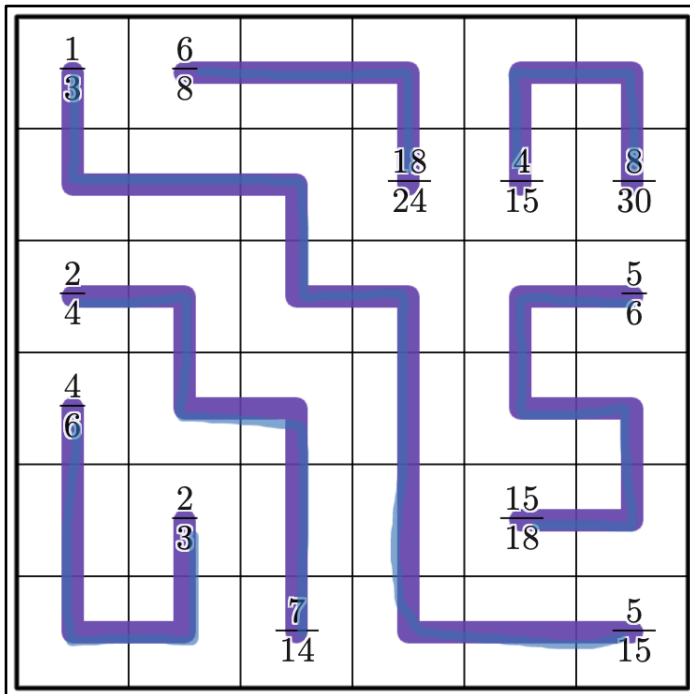
Place the following numbers in ascending order (from least to greatest).

$$6\frac{4}{7} \quad \frac{60}{9} \quad 8\frac{1}{4} \quad \frac{240}{30} \quad \frac{77}{10} \quad 6\frac{11}{12}$$

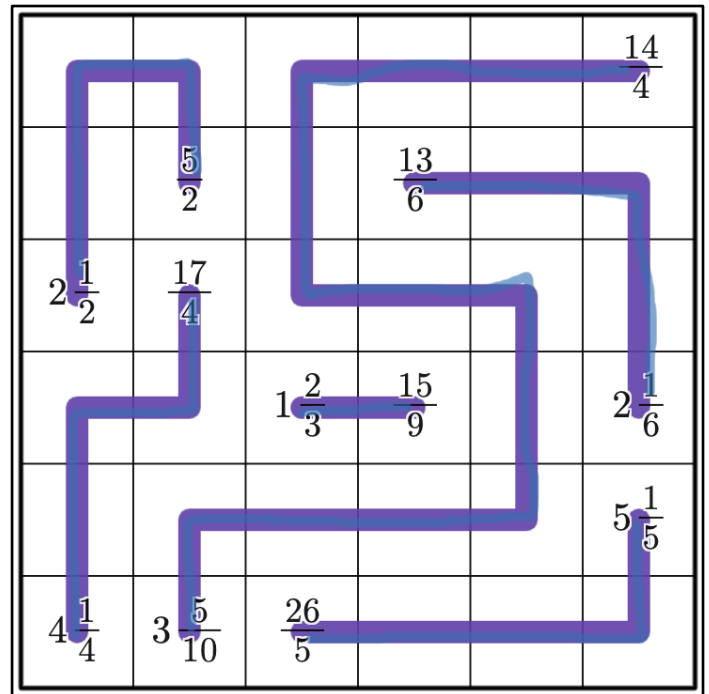
$$6\frac{4}{7} < \frac{60}{9} < 6\frac{11}{12} < \frac{77}{10} < \frac{240}{30} < 8\frac{1}{4}$$

Some of the quests have pipeflow puzzles. These can be quite challenging, so solutions are included below. Only peek if absolutely necessary.

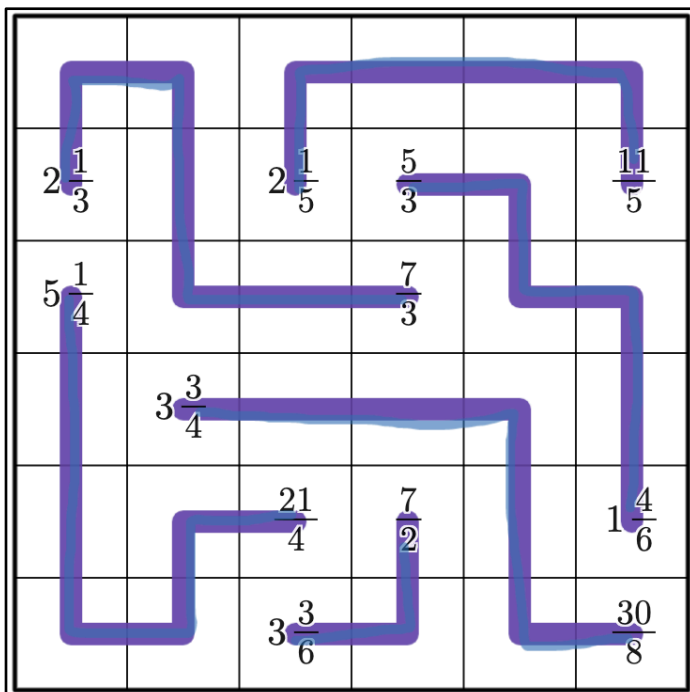
2.2



2.4



2.5



2.6

