A recipe that makes 8 servings of minestrone soup requires 1 1/2 cups of chopped celery and 2 1/4 cups of noodles. If you want to make 20 servings, how many cups of celery and noodles will you need?

A. 2 3/4 cups celery, 3 5/8 cups noodles
B. 3 1/2 cups celery, 3 3/4 cups noodles
C. 3 3/4 cups celery, 5 5/8 cups noodles
D. 5 3/2 cups celery, 3 5/8 cups noodles

Proportions, multiplying and reducing fractions.

Key question: How much more (proportionally) is 20 servings than 8?

Solution 1: Apply proportion directly to equation

$1\frac{1}{2}$ celery + $2\frac{1}{4}$ noodles = 8 servings

$= \frac{3}{2}c + \frac{9}{4}n = 8s$

Adjust Recipe → $8 * p = 20$ ← find proportion "p"

$p = \frac{20}{8} = \frac{10}{4} = \frac{5}{2}$

Multiply amounts of celery & noodles by proportion:

$\left(\frac{3}{2} * \frac{5}{2}\right)c + \left(\frac{9}{4} * \frac{5}{2}\right)n = \left(\frac{5}{2} * \frac{8}{1}\right)s$

$\frac{15}{4}c + \frac{45}{8}n = \frac{40}{2}s$

$3\frac{3}{4}c + 5\frac{5}{8}n = 20s$ ✓

Solution 2: Eliminate fractions, then apply proportion

$\frac{3}{2}c + \frac{9}{4}n = 8s$ Multiply all by 4

$\frac{12}{2}c + 9n = 32s \Rightarrow 6c + 9n = 32s$

Adjust recipe → $32 * p = 20 \Rightarrow p = \frac{20}{32} = \frac{10}{16} = \frac{5}{8}$

Multiply amounts of celery & noodles by proportion:

$\left(6 * \frac{5}{8}\right)c + \left(9 * \frac{5}{8}\right)n = \left(32 \cdot \frac{5}{8}\right)s$

$\frac{30}{8}c + \frac{45}{8}n = \frac{160}{8}s$ Reduce

$\frac{15}{4}c + \frac{45}{8}n = 20s$

$3\frac{3}{4}c + 5\frac{5}{8}n = 20s$ ✓