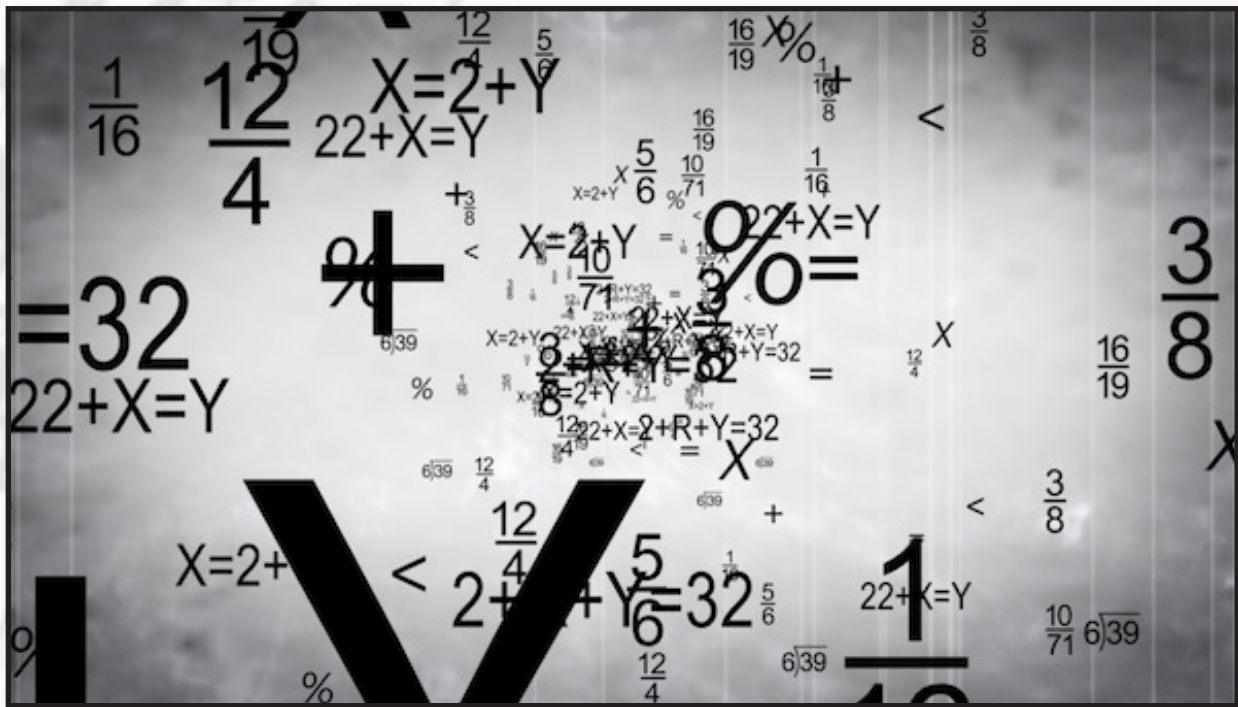


Math Review

Scenarios and Problems *Student Guide*



Module 4: Operations with Fractions

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Operations with Fractions (Lineworker)

Scenario

Sam is the head linesman for an overhead line crew that has been restoring power after a significant thunderstorm. His crew is on their way to the next job when he gets a call from Justin, a dispatcher.

“Hi, Sam, this is Justin. We might need some additional help on the east side of town. How much time is the crew going to have left?”

“We are $8\frac{1}{2}$ hours into our 16-hour shift,” Sam says. “We have four neighborhoods left: the Cascades, Whispering Pines, Middlebrook, and Stone Crest. Barring any setbacks and including travel time, we will spend $2\frac{1}{2}$ hours at the Cascades, 2 hours at Whispering Pines, $1\frac{3}{4}$ hours at Middlebrook, and $\frac{3}{4}$ of an hour at Stone Crest.”

If Sam’s crew cannot work more than 16 continuous hours, how much time does the crew **have left** to help with the east side of town?

- A. 1 hour
- B. $\frac{1}{2}$ hour
- C. $\frac{5}{12}$ hour
- D. $\frac{3}{4}$ hour



A thunderstorm has caused power outages
Courtesy NOAA, image is in the public domain

Problems

Adding and Subtracting Fractions

Eve, an engineering tech, is working with an overhead line crew doing thermal inspections of the line taps in an industrial park. The crew did $\frac{2}{3}$ of the taps in one section of the park and $\frac{1}{5}$ of the taps in a different section. What fraction of the taps has Eve and the crew inspected?

- A. $\frac{2}{15}$ of the taps
- B. $\frac{3}{10}$ of the taps
- C. $\frac{13}{15}$ of the taps
- D. $\frac{3}{4}$ of the taps

The line crew is running ground wires for overhead sensing insulators. The crew used $\frac{1}{2}$ of a spool for one job, $\frac{1}{4}$ of a spool for another, and $\frac{1}{6}$ of a spool for the final job. What fraction of the ground line spool **remains**?

- A. $\frac{11}{12}$ of a spool
- B. $\frac{1}{3}$ of a spool
- C. $1 \frac{1}{3}$ of a spool
- D. $\frac{1}{12}$ of a spool

Bob is a stock handler responsible for restocking the overhead line distribution trucks at the end of the day. Bob finds one truck has $\frac{1}{4}$ of a case of wedge connectors remaining. The other truck has $\frac{1}{3}$ of a case of wedge connectors remaining. What fraction of a case did Bob find on the 2 trucks?

- A. $\frac{1}{12}$ of a case
- B. $\frac{1}{6}$ of a case
- C. $\frac{2}{7}$ of a case
- D. $\frac{7}{12}$ of a case

Adding and Subtracting Mixed Numbers

Zac is an electrician responsible for adding oil to network transformers. Zac has added the following amounts of oil to 5 network transformers: $\frac{1}{2}$ of a gallon, $\frac{1}{3}$ of a gallon, $\frac{1}{4}$ of a gallon, $\frac{3}{4}$ of a gallon, and $\frac{2}{3}$ of a gallon. How many gallons of oil did Zac use to fill the 5 transformers?

- A. $2\frac{1}{2}$ gallons
- B. $1\frac{1}{2}$ gallons
- C. $2\frac{1}{4}$ gallons
- D. $2\frac{8}{12}$ or $2\frac{2}{3}$ gallons

René is an engineering technician working with the overhead line crew doing thermal inspections of wire taps. The crew had 19 miles of wire to inspect. During their first inspection period, the crew did $3\frac{1}{3}$ miles. In the second inspection period, the crew inspected $5\frac{1}{2}$ miles. After lunch, the crew inspected an additional $6\frac{3}{4}$ miles. How many miles of wire do René and the crew **have left** to inspect?

- A. $15\frac{7}{12}$ miles
- B. $1\frac{7}{12}$ miles
- C. $3\frac{5}{12}$ miles
- D. $1\frac{1}{2}$ miles

Lynne and her line crew were notified that down ground wires are missing from multiple poles in the town. The crews have to do a drive-by inspection, identify how many poles will need new down ground wires, and record their inspections in mileage inspected. The crews completed the following mileage of inspections: $1\frac{3}{4}$ miles, $5\frac{1}{2}$ miles, $3\frac{1}{3}$ miles, and $8\frac{1}{6}$ miles. How many miles did the crews inspect?

- A. $17\frac{3}{4}$ miles
- B. 18 miles
- C. $18\frac{2}{5}$ miles
- D. $18\frac{3}{4}$ miles

Multiplying and Dividing Fractions

Transformer visual inspections take $\frac{1}{3}$ of an hour to complete. Pete's line crew has 10 inspections to complete. How many hours of inspections will the crew need for all 10 of the inspections?

- A. $3 \frac{1}{3}$ hours
- B. 3 hours
- C. 30 hours
- D. 5 hours

Holly is a stock person who is responsible for restocking the overhead trucks at the end of the day. Holly has $\frac{1}{2}$ of a case of fuses to divide among 6 overhead line distribution trucks. What fraction of the fuse case will be put on each of the trucks?

- A. $\frac{1}{12}$ of the case
- B. $\frac{1}{6}$ of the case
- C. $\frac{1}{3}$ of the case
- D. $\frac{1}{9}$ of the case

Tom's overhead line distribution crew is responding to a power outage impacting 52 residential customers. The crew estimates that each customer's restoration will take about $\frac{1}{5}$ of an hour. How many hours will it take Tom's crew to restore all the customers?

- A. $10 \frac{1}{5}$ hours
- B. 10 hours
- C. $10 \frac{2}{5}$ hours
- D. $10 \frac{3}{5}$ hours

Multiplying and Dividing Mixed Numbers

Sarah and the overhead line crews are performing patroller inspections after a storm passed through a portion of the town. The crew has $5\frac{1}{3}$ miles to patrol. Sarah decided to split the crew into 4 separate teams to speed up the inspections. How many miles does each crew have to inspect?

- A. $1\frac{1}{3}$ miles
- B. $1\frac{1}{2}$ miles
- C. $1\frac{2}{7}$ miles
- D. $2\frac{2}{3}$ miles

Gail has $5\frac{1}{4}$ gallons of oil that she will distribute evenly into 6 network transformers. What amount of oil will Gail add to each transformer?

- A. $\frac{3}{4}$ of a gallon
- B. $\frac{7}{8}$ of a gallon
- C. $\frac{1}{8}$ of a gallon
- D. $\frac{1}{6}$ of a gallon

Darren has $3\frac{2}{3}$ boxes of 100-amp fuses on the line trucks, but the overhead line distribution crew needs 4 times as many boxes to respond to a significant power outage. How many boxes of 100-amp fuses does Darren have to get out of the warehouse to restock the line trucks as the overhead linemen requested?

- A. $14\frac{2}{3}$ boxes
- B. $12\frac{2}{3}$ boxes
- C. $14\frac{1}{3}$ boxes
- D. $13\frac{2}{3}$ boxes

Operations with Fractions (Plant Operator)

Scenario

“Hi, Devon. Looks like we have two generators going right now,” Jeannine, a plant operator, says as she comes on for her shift.

“Yes, they are the 10 Megawatt generators,” Devon replies.

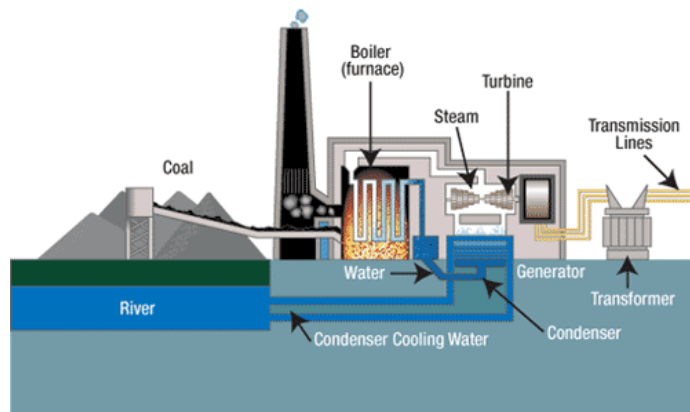
“How is our cooling water flow looking for the two?”

“Looks like Generator #1 is receiving about $\frac{5}{12}$ of the total available cooling water and Generator #2 is receiving about $\frac{1}{3}$ of the total available cooling water.”

“So, Generator #1 is still requiring a little more water than Generator #2.”

How much more of the total water flow is Generator #1 receiving?

- A. $\frac{2}{12}$ or $\frac{1}{6}$ of the total water flow
- B. $\frac{3}{12}$ or $\frac{1}{4}$ of the total water flow
- C. $\frac{1}{12}$ of the total water flow
- D. $\frac{11}{12}$ of the total water flow



Power plants often get their cooling water from nearby rivers
Courtesy TVA, image is in the public domain

Problems

Adding and Subtracting Fractions

Enrique, a plant operator, is reviewing a parts inventory and sees that there are two cases of spare air filters. The first case was $\frac{1}{2}$ full and the second was $\frac{1}{3}$ full. What is the total number of cases available in inventory?

- A. $\frac{5}{6}$ cases
- B. $\frac{2}{5}$ cases
- C. $\frac{2}{3}$ cases
- D. $\frac{1}{6}$ cases

The coal train had two cars with only partial loads. One was $\frac{2}{5}$ full and the other was $\frac{1}{5}$ full. If both loads were placed in one coal car, how full would it be?

- A. $\frac{3}{10}$ full
- B. $\frac{3}{5}$ full
- C. $\frac{2}{25}$ full
- D. $\frac{1}{5}$ full

Two partial train cars of coal were delivered today. By weight, the first car was $\frac{13}{32}$ full and the second was $\frac{5}{8}$ full. What is the sum of the two carloads?

- A. $\frac{5}{32}$ full carload
- B. $1 \frac{1}{32}$ full carload
- C. $\frac{20}{32}$ or $\frac{5}{8}$ full carload
- D. $\frac{10}{32}$ or $\frac{5}{16}$ full carload

A 200,000-cubic-foot coal silo started the shift at $\frac{7}{8}$ full volume. During the shift, half of the total silo volume was used. How much, by fraction of volume, is left in the silo?

- A. $\frac{1}{2}$ total silo volume
- B. $\frac{1}{8}$ total silo volume
- C. $\frac{3}{8}$ total silo volume
- D. $\frac{5}{8}$ total silo volume

During a recent inspection of the water purification system, $\frac{1}{8}$ of the purification columns were undergoing scheduled maintenance, and an additional $\frac{1}{8}$ of the columns were offline and needed to be back-flushed due to low flow rates. What fraction of the total purification columns is still available for use?

- A. $\frac{2}{8}$ or $\frac{1}{4}$ of the columns
- B. $\frac{6}{8}$ or $\frac{3}{4}$ of the columns
- C. $\frac{2}{16}$ or $\frac{1}{8}$ of the columns
- D. $\frac{1}{2}$ of the columns

Adding and Subtracting Mixed Numbers

Kari, a new plant operator, is preparing her work plans for the day. The two jobs she was assigned each came with procedure cards that listed materials needed, estimated time for completion, and the steps of the procedure listed out. If the first job had an estimated time of $2\frac{1}{2}$ hours and the second was estimated to take $1\frac{3}{4}$ hours, how many total estimated hours of maintenance was Kari assigned?

- A. $3\frac{2}{3}$ hours
- B. $4\frac{1}{4}$ hours
- C. $4\frac{1}{2}$ hours
- D. $3\frac{1}{4}$ hours

A monthly tally of the bottom ash shipped back to the coal company showed that two shipments were sent. The first shipment sent $10\frac{1}{3}$ rail cars of ash and the second sent $12\frac{5}{6}$ rail cars of ash. How many total rail cars of ash were sent for the month?

- A. $22\frac{6}{9}$ or $22\frac{2}{3}$ rail cars
- B. $23\frac{1}{3}$ rail cars
- C. $24\frac{2}{6}$ or $24\frac{1}{3}$ rail cars
- D. $23\frac{1}{6}$ rail cars

While reviewing inventory, Enrique noted there were $16\frac{1}{2}$ gallons of lube oil for the back-up generator. If the generator takes $8\frac{3}{4}$ gallons of oil, how much oil will be left in inventory after the next generator oil change?

- A. $8\frac{1}{4}$ gallons
- B. $7\frac{3}{4}$ gallons
- C. $7\frac{1}{2}$ gallons
- D. $8\frac{1}{2}$ gallons

After recording the air compressor's run time for the week, Kari noted that last week's total run time was $2,356\frac{7}{10}$ hours and this week's total run time is $2,395\frac{3}{10}$ hours. How many more hours did the air compressor run this week than last week?

- A. $41\frac{4}{10}$ or $41\frac{2}{5}$ hours
- B. $42\frac{1}{10}$ hours
- C. $38\frac{6}{10}$ or $38\frac{3}{5}$ hours
- D. $39\frac{5}{10}$ or $39\frac{1}{2}$ hours

Multiplying and Dividing Fractions

Enrique, preparing for his maintenance day, sees that he has 3 water pumps that each have an estimated $\frac{1}{4}$ hour preventive maintenance task scheduled and a tank cleaning task listed at 5 hours. If he chooses to do work on just the pumps before taking a break, how long should it take?

- A. 3 hours
- B. $\frac{3}{4}$ hour
- C. $\frac{1}{2}$ hour
- D. $\frac{4}{3}$ or $1\frac{1}{3}$ hours

Kari is performing preventive maintenance on a group of 6 hydraulic valves by changing out the hydraulic fluid. If each valve has a hydraulic fluid capacity of $\frac{1}{8}$ gallons, how many gallons of hydraulic fluid will Kari use?

- A. $\frac{8}{6}$ or $1\frac{1}{3}$ gallons
- B. $\frac{1}{6}$ gallons
- C. $\frac{6}{8}$ or $\frac{3}{4}$ gallons
- D. $\frac{2}{3}$ gallons

Enrique is restocking supplies in the 3 water testing stations and wants to distribute the $\frac{1}{2}$ case of litmus paper packs he has in stock evenly between the sampling stations. What fraction of the case should he stock each station with?

- A. $\frac{1}{3}$ of the case
- B. $\frac{1}{4}$ of the case
- C. $\frac{1}{5}$ of the case
- D. $\frac{1}{6}$ of the case

Each quarter, $\frac{1}{8}$ of the solar cell array is bench tested for effectiveness. If the electrical shop wants to test an equal amount of the array each month of the 3-month quarter, what fraction of the total array is tested each month?

- A. $\frac{1}{24}$ of the array
- B. $\frac{3}{8}$ of the array
- C. $\frac{1}{3}$ of the array
- D. $\frac{3}{24}$ or $\frac{1}{8}$ of the array

Multiplying and Dividing Mixed Numbers

Enrique, after restocking supplies in the plant's 4 watch stations, notes that there were $1\frac{1}{2}$ boxes of ear plugs at each station. How many total boxes of ear plugs were in all 4 watch stations?

- A. 6 boxes
- B. $4\frac{1}{2}$ boxes
- C. $4\frac{2}{2}$ or 2 boxes
- D. 5 boxes

Kari is preparing for the plant maintenance shutdown by readying work packages on the generators. If the air filter replacement for each of the 3 generators takes an estimated $2\frac{3}{4}$ hours, how many total hours is needed to replace the air filters in the 3 generators?

- A. $8\frac{1}{4}$ hours
- B. $6\frac{9}{12}$ or $6\frac{3}{4}$ hours
- C. $6\frac{1}{2}$ hours
- D. $8\frac{1}{2}$ hours

Enrique received $6\frac{1}{2}$ pallets with buckets of bearing grease. If each pallet holds 8 buckets and Enrique wants to evenly distribute the buckets to 4 plants, how many pallets should he send to each plant?

- A. 13 buckets
- B. $1\frac{5}{8}$ pallets
- C. $1\frac{1}{2}$ pallets
- D. 10 buckets

Kari took $4\frac{1}{2}$ hours to complete a preventive maintenance task that tested the motor balance of 6 water pumps. If each pump took the same amount of time to test, how many hours did each pump's test take?

- A. $\frac{3}{4}$ hours
- B. $\frac{1}{2}$ hours
- C. $1\frac{1}{2}$ hours
- D. $1\frac{1}{4}$ hours

Operations with Fractions (Pipefitter/Pipelayer/Welder) Scenario

Roberto is welding a stainless steel gas main on a new pipeline project.

“Hi, Roberto. How many welds do you have left?” Jill, Roberto’s supervisor, asks during their lunch break.

“I think I have 3 welds left. We have another 4 hours to get this job done, correct?”

“Right. Are you going to finish on time?”

“It was taking me about 1 1/2 hours to prep and finish 1 weld this morning.”

If Roberto maintains the same 1 1/2 hours per 1 weld rate, will he finish on time?

- A. Yes, he’ll need 3 1/2 hours to complete the job
- B. No, he’ll need 4 1/2 hours to complete the job
- C. Yes, he’ll need 4 hours to complete the job
- D. No, he’ll need 6 hours to complete the job



Roberto is welding new gas lines
Courtesy U.S. DOT, image is in the public domain

Problems

Adding and Subtracting Fractions

Jim, a welding inspector, is reviewing welds on steel plates being used to cover a trench cut through a town road. Jim found that $\frac{1}{5}$ of the welds had undercut, which is a weld root that is left unfilled by weld metal, on one set of plates and $\frac{1}{7}$ of the welds had undercut on the other plate. What fraction of the welds had undercut?

- A. $\frac{12}{35}$ of the welds had undercut
- B. $\frac{1}{6}$ of the welds had undercut
- C. $\frac{2}{35}$ of the welds had undercut
- D. $\frac{2}{12}$ or $\frac{1}{6}$ of the welds had undercut

Kath was making multiple passes to complete a weld. On her first pass, Kath filled $\frac{1}{2}$ of the gap. On Kath's second pass, she filled an additional $\frac{1}{3}$ of the weld gap. How much of the total weld gap has Kath filled on the 2 passes?

- A. $\frac{2}{5}$ of the weld gap filled
- B. $\frac{1}{6}$ of the weld gap filled
- C. $\frac{5}{6}$ of the weld gap filled
- D. $\frac{2}{6}$ or $\frac{1}{3}$ of the weld gap filled

Enrique is a stock handler responsible for restocking the gas distribution trucks at the end of the day. Enrique finds one truck has $\frac{1}{4}$ of a case of plastic gas fittings remaining. The other truck has $\frac{1}{3}$ of a case of plastic fittings remaining. What fraction of a case has Enrique found on the 2 trucks?

- A. $\frac{1}{12}$ of a case
- B. $\frac{1}{6}$ of a case
- C. $\frac{2}{7}$ of a case
- D. $\frac{7}{12}$ of a case

Adding and Subtracting Mixed Numbers

Jill is an apprentice gas distribution mechanic. She is inspecting residential gas meters on homes in a local neighborhood. Jill has $3\frac{1}{3}$ miles to inspect on one street and $2\frac{1}{5}$ miles on another. How many miles does Jill have to inspect?

- A. $5\frac{1}{8}$ miles
- B. $5\frac{1}{4}$ miles
- C. $5\frac{8}{15}$ miles
- D. $5\frac{1}{15}$ miles

Gail is completing 2 welds in the remaining 5 hours of her work day. The first weld is going to take $1\frac{1}{4}$ hours to prep and weld. The second weld is going to take $2\frac{1}{2}$ hours to prep and weld. How much time will Gail **have left** in the remaining 5 hours of her work day?

- A. $3\frac{3}{4}$ hours
- B. $3\frac{1}{4}$ hours
- C. $1\frac{1}{4}$ hours
- D. $1\frac{3}{4}$ hours

Frank and his gas crew have responded to a gas system outage of 45 customers in a residential neighborhood. Frank has split his crew into 2 working groups to relight customer pilot lights. One crew had estimated they had relit $\frac{1}{3}$ of the customers in the first hour. The second crew estimated they had relit $\frac{1}{5}$ of the customers. What fraction of the customers still need to have their pilot lights relit?

- A. $\frac{7}{15}$ of the customers remain
- B. $\frac{1}{4}$ of the customers remain
- C. $\frac{1}{15}$ of the customers remain
- D. $\frac{8}{15}$ of the customers remain

Multiplying and Dividing Fractions

Tom's gas distribution crew is responding to a gas outage impacting 20 residential customers. The crew estimates $\frac{1}{5}$ of an hour to relight each pilot light. How many hours will it take Tom's crew to relight all the pilots?

- A. 4 hours
- B. $1\frac{3}{4}$ hours
- C. 8 hours
- D. 5 hours

Dan and his gas distribution crew have responded to the report of a gas valve failure. The valve failure resulted in $\frac{1}{3}$ of all the customer on the street to be without service. In order to repair the valve, the crew has to shut off the gas to 3 times as many customers on the street. What fraction of customers will be without service during this repair?

- A. $\frac{2}{3}$ of the street's customers
- B. $\frac{1}{9}$ of the street's customers
- C. All the street's customers
- D. $\frac{1}{6}$ of the street's customers

Marla is a stock person who is responsible for restocking the gas trucks at the end of the day. Marla has $\frac{1}{2}$ of a case of fittings to evenly divide among 6 gas trucks. What fraction of a case of fittings will be put on each of the trucks?

- A. $\frac{1}{12}$ of a case of fittings
- B. $\frac{1}{6}$ of a case of fittings
- C. $\frac{1}{3}$ of a case of fittings
- D. $\frac{1}{9}$ of a case of fittings

Multiplying and Dividing Mixed Numbers

Sue has $1\frac{1}{5}$ boxes of welding rods available for each of the 4 welders welding high-pressure steel gas mains. How many total boxes of welding rods does Sue have available?

- A. $1\frac{4}{5}$ boxes
- B. $4\frac{1}{5}$ boxes
- C. $4\frac{4}{5}$ boxes
- D. 5 boxes

Vinny and his gas crews are relighting pilot lights in an apartment complex where they repaired a gas leak. Vinny's crews are responsible for $2\frac{1}{3}$ of the apartment buildings in the complex that need their pilot lights relit. Vinny has divided his crew into 4 working groups to speed up the relight process. If all groups help an equal number of buildings, what fraction of the buildings will each crew handle?

- A. $1\frac{5}{7}$ of the buildings
- B. $\frac{5}{7}$ of the buildings
- C. $\frac{7}{12}$ of the buildings
- D. $\frac{3}{12}$ or $\frac{1}{4}$ of the buildings

Darren has $3\frac{2}{3}$ boxes of plastic gas fittings. The gas distribution crew has 8 customers requiring the installation of plastic pipe into their homes. What fraction of the plastic gas fittings will be divided among the 8 customers?

- A. $\frac{11}{24}$ of the fittings
- B. $\frac{1}{2}$ of the fittings
- C. $\frac{2}{3}$ of the fittings
- D. $\frac{3}{8}$ of the fittings