



MATHEMATICS

Real-World Problem Solving

Complete Student Edition

GLOBAL SOVEREIGN UNIVERSITY

"Building a Bridge to Freedom Through Education

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Why This Book Is Different



NOBEL PRIZE RESEARCH SAYS:

"Students who score 96% on classroom math tests succeed only 1% of the time in real life."

— Banerjee & Duflo, *Nature*, February 2025

The Research That Proves Traditional Math Education Fails

In February 2025, Nobel Prize-winning economists published a groundbreaking study in *Nature*, the world's most respected scientific journal. They tested over 1,400 children in India and discovered something shocking:

Children who ace classroom math CANNOT use it in the real world.

Students who scored 96% on standard school math problems could solve simple real-world market calculations only 1% of the time. Meanwhile, children who worked in markets—without formal education—solved the same problems with 96% accuracy.

The researchers' conclusion was clear:

"Schools need to build a bridge between math learned in the classroom and math encountered in real-life situations."

The Problem: Abstract Doesn't Transfer to Applied

The Nobel laureates found that schoolchildren learned *procedures* but not *understanding*. They could solve " 24×8 " on a worksheet by adding 24 eight times. But give them a real problem—"How much do 8 items cost at \$24 each?"—and they froze.

Market children used efficient mental strategies: breaking 11×43 into $(10 \times 43) + 43$, rounding for easier calculation, and working with meaningful quantities. Schoolchildren followed rigid, slow methods that worked for tests but failed in life.

It's not that school kids were less intelligent. It's that their education never connected the math to reality.

The GSU Solution: Real-World Math

This textbook does exactly what the Nobel laureates recommend. Instead of abstract problems, every calculation has a professional context:

Traditional Math

"Multiply 3.45×6.8 "

"Find 15% of 80"

"Add $\frac{2}{3} + \frac{3}{4}$ "

GSU Real-World Math

"You're the Restaurant Manager. Your order is 6.8 pounds at \$3.45/lb. What's the cost?"

"A customer's bill is \$80. Calculate the 15% tip."

"Your recipe needs $\frac{2}{3}$ cup butter and $\frac{3}{4}$ cup oil. Total fat?"

Same math. Completely different learning.

The Bottom Line

Nobel Prize-winning researchers proved that traditional education fails to prepare students for real-world math. The gap between classroom success and life success is catastrophic: 96% to 1%.

This textbook closes that gap.

Every problem. Every skill. Every chapter. Connected to reality.

"Because math isn't an academic exercise. It's a survival skill."

Dr. Gene A Constant

Global Sovereign University is a 501(c)(3) educational foundation. This textbook is provided FREE because learning should never be limited by economics.

Research Citation:

Banerjee, A., Duflo, E., et al. (2025). Children's arithmetic skills do not transfer between applied and academic mathematics. *Nature*. <https://doi.org/10.1038/s41586-024-08502-w>

The lead authors received the 2019 Nobel Prize in Economics "for their experimental approach to alleviating global poverty."

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The GSU Difference

Traditional Math Education

- Learn abstract rules
- Practice disconnected problems
- Take a test
- Forget everything
- Graduate unable to balance a checkbook

GSU Real-World Math

- You ARE the restaurant manager calculating tips
- You ARE the warehouse supervisor measuring volume
- You ARE the business owner tracking profit
- You solve problems you will actually face
- You build skills that earn money

The difference is not just how you learn.

It is whether you can USE what you learn.

Nobel Prize winners proved that traditional education fails. We built the alternative.

Real-World Review Problems

Additional mixed practice from all chapters

Mixed Review Set 1: Restaurant & Retail

1. Food order: 12.5 lbs chicken at \$4.89/lb + 8.75 lbs beef at \$7.25/lb. Total?

Work: _____

Answer: _____

2. Bill is \$86.50. Customer pays with \$100. Calculate 8% tax, then change from \$100.

Work: _____

Answer: _____

3. Table of 6 wants to split \$234.60 bill evenly plus 20% tip. Each person pays?

Work: _____

Answer: _____

4. Buy wholesale at \$24, markup 85%. Selling price? Then offer 25% off sale. Sale price?

Work: _____

Answer: _____

5. Daily sales: Mon \$1,245, Tue \$1,567, Wed \$1,389, Thu \$1,678, Fri \$2,134. Mean? Range?

Work: _____

Answer: _____

6. If Saturday sales grow 15% from Friday, projection?

Work: _____

Answer: _____

Mixed Review Set 2: Shipping & Construction

1. Warehouse: $50 \times 40 \times 15$ ft. Volume? How many 8 ft³ boxes fit?

Work: _____

Answer: _____

2. Package: $24 \times 18 \times 16$ in. Dim weight ($\div 139$)? Ship at \$0.58/lb?

Work: _____

Answer: _____

3. L-shaped floor: main 60×45 ft + extension 30×25 ft. Total area?

Work: _____

Answer: _____

4. Same L-shape. Carpet costs \$4.50/sq ft. Total carpet cost?

Work: _____

Answer: _____

5. Rectangle 75×50 ft with 15×10 pool cutout. Deck area?

Work: _____

Answer: _____

6. Fence the deck with two 4 ft gates. Fence needed?

Work: _____

Answer: _____

Mixed Review Set 3: Time, Travel & Data

1. Flight departs Seattle (PT) 7:45 AM, flies 5 hr 15 min to Miami (ET). Arrival local?

Work: _____

Answer: _____

2. Meeting in Tokyo (14 hrs ahead of PT) at 9 AM Tokyo time. PT time?

Work: _____

Answer: _____

3. Trip costs: Air \$2,850, Hotel \$1,995, Food \$840, Activities \$675, Transport \$340. Total? Split 5 ways?

Work: _____

Answer: _____

4. Player stats: 22, 18, 31, 25, 19, 28, 24, 17. Mean? Median? Range?

Work: _____

Answer: _____

5. Same player: Identify any outlier. Recalculate mean without it.

Work: _____

Answer: _____

6. Player averages 23 pts. Win bonus \$50/point above 20. Bonus for 82-game season?

Work: _____

Answer: _____

Mixed Review Set 4: Fractions & Formulas

1. Recipe needs: $2\frac{1}{3}$ cups flour + $1\frac{3}{4}$ cups sugar + $\frac{2}{3}$ cup butter. Total ingredients?

Work: _____

Answer: _____

2. Scale the recipe $\times 3$. New flour amount?

Work: _____

Answer: _____

3. Had 5 lbs butter, used $2\frac{5}{8}$ lbs. Remaining?

Work: _____

Answer: _____

4. Calculate: $5 \times (8 - 3)^2 + 15 \div 3$

Work: _____

Answer: _____

5. Calculate: $2^4 + 3^3 - 5 \times 6$

Work: _____

Answer: _____

6. Density = Mass \div Volume. $M = 350\text{g}$, $V = 25\text{ cm}^3$. Density?

Work: _____

Answer: _____

Mixed Review Set 5: Business Planning

1. Startup costs: Equipment \$8,450, Software \$2,375, Legal \$1,850, Marketing \$3,200. Total?

Work: _____

Answer: _____

2. Sell product at \$45, cost \$18. Profit per item? Profit margin %?

Work: _____

Answer: _____

3. Fixed costs \$2,400/month. Profit \$27/item. Break-even quantity?

Work: _____

Answer: _____

4. Month 1: \$12,000 sales. Growing 20%/month. Month 4 projection?

Work: _____

Answer: _____

5. Annual revenue \$156,000. Total costs \$98,000. Net profit? Profit margin?

Work: _____

Answer: _____

6. Reinvest 35% of profit. Reinvestment amount? Remaining for owners?

Work: _____

Answer: _____

Welcome, Fifth Grade Mathematician!

Fifth grade mathematics opens doors to careers you can start building TODAY. This year, you'll take on professional roles that use mathematics every single day.

Your Roles This Year:

- **Restaurant Manager:** Calculate food costs, tips, and pricing
- **Warehouse Supervisor:** Measure volume and manage shipping
- **Video Game Designer:** Plot coordinates and create game worlds
- **Catering Chef:** Scale recipes for any size event
- **Landscaping Contractor:** Calculate areas and order materials
- **Sports Analyst:** Crunch statistics for teams
- **Travel Agent:** Plan trips across time zones
- **Small Business Owner:** Track profit, loss, and growth
- **Science Lab Technician:** Follow precise formulas and procedures
- **Startup Founder:** Launch your own business!

These aren't pretend jobs. These are skills you can use THIS WEEK to help your family, earn money, or solve real problems.

CHAPTER 1

The Restaurant Manager

Chapter Goal: Master decimals, percentages, and money calculations to run a successful restaurant.

Congratulations! You've just been promoted to Restaurant Manager at the family diner. Every day, you'll calculate food costs to three decimal places, figure out tips and taxes, set menu prices, and track daily revenue. One decimal point in the wrong place can cost hundreds of dollars!

Section 1: Reading the Receipts — Decimals to Thousandths

?? The Scenario

Your food supplier sends invoices with prices to the thousandth of a dollar. Coffee beans cost \$7.425 per pound. Cooking oil costs \$3.875 per gallon. Understanding these precise decimals helps you track costs and spot errors.

?? The Skill: Decimal Place Value

Decimals extend place value to the right of the decimal point:

- Tenths (0.1) — one decimal place
- Hundredths (0.01) — two decimal places (pennies!)
- Thousandths (0.001) — three decimal places (mills)

Worked Example: Understanding \$7.425

7 is in the ones place = \$7.00

4 is in the tenths place = \$0.40 (40 cents)

2 is in the hundredths place = \$0.02 (2 cents)

5 is in the thousandths place = \$0.005 (half a cent)

Total: \$7.00 + \$0.40 + \$0.02 + \$0.005 = \$7.425

When you buy 100 pounds, that half-cent becomes 50 cents!

Worked Example: Comparing \$3.875 and \$3.85

Line up decimal points and compare left to right:

Ones: Both have 3

Tenths: Both have 8

Hundredths: 7 vs 5 → 7 > 5

Answer: \$3.875 > \$3.85 (Supplier A is more expensive)

Worked Example: Rounding \$4.627 to the Nearest Cent

The nearest cent = nearest hundredth

Look at thousandths digit: 7

Is it 5 or more? YES → Round up

Answer: \$4.627 rounds to \$4.63

 **Worked Example: Writing Decimals in Expanded Form**

$\$12.345 =$

$$10 + 2 + 0.3 + 0.04 + 0.005$$

$$\text{Or: } (1 \times 10) + (2 \times 1) + (3 \times 0.1) + (4 \times 0.01) + (5 \times 0.001)$$

 **Practice: Decimal Place Value**

1. What is the value of the 6 in $\$45.678$?

Work: _____

Answer: _____

2. Write $\$23.456$ in expanded form.

Work: _____

Answer: _____

3. Round $\$7.834$ to the nearest cent (hundredth).

Work: _____

Answer: _____

4. Compare using $<$, $>$, or $=$: 5.67 ____ 5.670

Work: _____

Answer: _____

5. What digit is in the thousandths place of 12.345 ?

Work: _____

Answer: _____

6. Round $\$9.999$ to the nearest cent.

Work: _____

Answer: _____

7. Order from least to greatest: 4.52 , 4.502 , 4.520 , 4.052

Work: _____

Answer: _____

8. Write in standard form: $8 + 0.3 + 0.05 + 0.007$

Work: _____

Answer: _____

9. Compare: 6.125 6.15

Work: _____

Answer: _____

10. Round $\$12.5849$ to the nearest cent.

Work: _____

Answer: _____

11. What is the value of the 9 in 34.789 ?

Work: _____

Answer: _____

12. Order from greatest to least: $7.08, 7.008, 7.8, 7.080$

Work: _____

Answer: _____

13. Write $\$156.025$ in expanded form.

Work: _____

Answer: _____

14. Round $\$0.9995$ to the nearest cent.

Work: _____

Answer: _____

15. Compare: 0.305 0.350

Work: _____

Answer: _____

16. Coffee costs $\$8.457/\text{lb}$, tea costs $\$8.475/\text{lb}$. Which costs less?

Work: _____

Answer: _____

17. What digit is in the hundredths place of 67.891 ?

Work: _____

Answer: _____

18. Round \$45.6789 to the nearest tenth.

Work: _____

Answer: _____

Section 2: Daily Totals — Adding and Subtracting Decimals

❖ The Scenario

At closing time, you total the day's receipts. The lunch shift earned \$1,234.56 and the dinner shift earned \$2,456.78. You also need to subtract expenses: \$345.67 for food delivery, \$123.45 for supplies.

❖ Worked Example: Adding: \$1,234.56 + \$2,456.78

Step 1: Line up decimal points

Step 2: Add column by column from right to left

$$\begin{array}{r} 1,234.56 \\ + 2,456.78 \\ \hline \end{array}$$

Answer: \$3,691.34

❖ Worked Example: Adding with Different Decimal Places: \$45.6 + \$23.45 + \$8.125

Add zeros to align: \$45.600 + \$23.450 + \$8.125

$$\begin{array}{r} 45.600 \\ 23.450 \\ + 8.125 \\ \hline \end{array}$$

Answer: \$77.175 (or \$77.18 rounded)

❖ Worked Example: Subtracting: \$500.00 - \$123.45

$$\begin{array}{r} 500.00 \\ - 123.45 \\ \hline \end{array}$$

Answer: \$376.55

❖ Worked Example: Calculating Net Revenue

Revenue: \$3,691.34

Expenses: \$345.67 + \$123.45 = \$469.12

Net: \$3,691.34 - \$469.12 = \$3,222.22

Answer: \$3,222.22 net revenue for the day

?? Practice: Adding and Subtracting Decimals

1. Add: $45.67 + 23.456$

Work: _____

Answer: _____

2. Add: $123.4 + 56.78 + 9.012$

Work: _____

Answer: _____

3. Subtract: $500.00 - 234.56$

Work: _____

Answer: _____

4. Lunch sales: \$1,567.89. Dinner: \$2,345.67. Total?

Work: _____

Answer: _____

5. Add: $7.8 + 12.34 + 0.567$

Work: _____

Answer: _____

6. Subtract: $1,000 - 456.789$

Work: _____

Answer: _____

7. Food cost: $\$234.56 + \$178.90 + \$345.67$. Total?

Work: _____

Answer: _____

8. Revenue \$3,456.78. Expenses \$1,234.56. Net?

Work: _____

Answer: _____

9. Add: $0.125 + 0.875 + 0.5$

Work: _____

Answer: _____

10. Subtract: $250.00 - 67.89$

Work: _____

Answer: _____

11. Three orders: \$12.45, \$8.90, \$15.67. Total?

Work: _____

Answer: _____

12. Budget \$2,500. Spent \$1,678.45. Remaining?

Work: _____

Answer: _____

13. Add: $99.99 + 88.88 + 77.77$

Work: _____

Answer: _____

14. Subtract: $1,234.567 - 890.123$

Work: _____

Answer: _____

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15. Monday \$1,234.56, Tuesday \$1,456.78, Wednesday \$1,345.67. Total?

Work: _____

Answer: _____

16. Had \$5,000. Expenses: \$456.78, \$234.56, \$789.12. Remaining?

Work: _____

Answer: _____

17. Add: $6.7 + 8.91 + 2.345 + 0.6789$

Work: _____

Answer: _____

18. Subtract: $10,000 - 4,567.89$

Work: _____

Answer: _____

Section 3: Bulk Orders — Multiplying Decimals

?? The Scenario

You order 24.5 pounds of chicken at \$4.25 per pound. How much will it cost? Multiplying decimals precisely is essential for accurate ordering.

Worked Example: Multiplying: $24.5 \times \$4.25$

Step 1: Multiply as whole numbers: $245 \times 425 = 104,125$

Step 2: Count decimal places: 1 (in 24.5) + 2 (in 4.25) = 3

Step 3: Place decimal 3 places from right: 104.125

Answer: \$104.125 (or \$104.13 rounded)

Worked Example: Multiplying Decimal by Whole Number: $15 \times \$6.75$

$15 \times 6.75 = 15 \times 675 = 10,125$

Two decimal places → 101.25

Answer: \$101.25

Worked Example: Multiplying Two Decimals: 2.5×3.4

$= 850$

$1 + 1 = 2$ decimal places → 8.50

Answer: 8.5

Worked Example: Real Application: Weekly Order

Order 45.5 pounds of beef at \$5.85/lb

$45.5 \times 5.85 = 455 \times 585 = 266,175$

$1 + 2 = 3$ decimal places → 266.175

Cost: \$266.18 (rounded)

?? Practice: Multiplying Decimals

1. Multiply: 3.4×5.6

Work: _____

Answer: _____

2. Multiply: 12.5×4

Work: _____

Answer: _____

3. 24 pounds × \$3.75/lb. Total cost?

Work: _____

Answer: _____

4. Multiply: 0.25×0.4

Work: _____

Answer: _____

5. Multiply: 15.5×2.5

Work: _____

Answer: _____

6. Order 36 gallons at \$2.45/gallon. Cost?

Work: _____

Answer: _____

7. Multiply: 8.125×8

Work: _____

Answer: _____

8. Multiply: 4.5×4.5

Work: _____

Answer: _____

9. 45.5 pounds \times \$5.85/lb. Total?

Work: _____

Answer: _____

10. Multiply: 0.6×0.7

Work: _____

Answer: _____

11. Multiply: 125×0.08 (8% tax)

Work: _____

Answer: _____

12. Order: 18.5 lbs chicken \times \$4.25/lb. Cost?

Work: _____

Answer: _____

13. Multiply: 6.25×3.2

Work: _____

Answer: _____

14. Multiply: 100×0.065 (6.5% tax)

Work: _____

Answer: _____

15. 28.5 hours \times \$12.50/hour. Earnings?

Work: _____

Answer: _____

16. Multiply: $2.5 \times 2.5 \times 2.5$

Work: _____

Answer: _____

17. Order: 55 gallons \times \$3.875/gallon. Cost?

Work: _____

Answer: _____

18. Multiply: 0.125×80

Work: _____

Answer: _____

Section 4: Tips and Taxes — Understanding Percentages

❖❖ The Scenario

A customer's bill is \$85.00. They want to leave a 20% tip. The sales tax is 8%. You need to calculate the tip, the tax, and the total. Understanding percentages is essential!

❖❖ The Skill: Converting Percentages

'Percent' means 'per hundred.' To convert:

- Percent to decimal: Divide by 100 (move decimal 2 places left)
- $20\% = 0.20$, $8\% = 0.08$, $15\% = 0.15$

❖ Worked Example: Calculating a 20% Tip on \$85.00

Step 1: Convert 20% to decimal: $20\% = 0.20$

Step 2: Multiply: $\$85.00 \times 0.20 = \17.00

Tip: \$17.00

 **Worked Example: Calculating 8% Tax on \$85.00**

Step 1: Convert 8% to decimal: $8\% = 0.08$

Step 2: Multiply: $\$85.00 \times 0.08 = \6.80

Tax: \$6.80

 **Worked Example: Total Bill with Tip and Tax**

Food: \$85.00

Tax (8%): \$6.80

Subtotal: \$91.80

Tip (20% of food): \$17.00

Total: \$108.80

 **Worked Example: Quick Tip Calculation: 15% Shortcut** To find

15%:

10% of \$60 = \$6.00 (move decimal one place left)

5% = half of 10% = \$3.00

15% = 10% + 5% = \$6.00 + \$3.00 = \$9.00

  **Practice: Percentages and Tips**

1. Convert to decimal: 25%

Work: _____

Answer: _____

2. Convert to decimal: 7.5%

Work: _____

Answer: _____

3. Calculate 20% of \$45.00

Work: _____

Answer: _____

4. Calculate 15% tip on \$80.00

Work: _____

Answer: _____

5. Calculate 8% tax on \$125.00

Work: _____

Answer: _____

6. Bill is \$65. Find 18% tip.

Work: _____

Answer: _____

7. Convert to decimal: 6.25%

Work: _____

Answer: _____

8. Calculate 10% of \$234.50

Work: _____

Answer: _____

9. Bill \$95.00, tax 8%, tip 20%. Total?

Work: _____

Answer: _____

10. Calculate 25% of \$180.00

Work: _____

Answer: _____

11. Food cost \$120. Tax 7%. Total with tax?

Work: _____

Answer: _____

12. Calculate 15% of \$55.00 using the shortcut method.

Work: _____

Answer: _____

13. Bill \$78.50. Calculate 20% tip.

Work: _____

Answer: _____

14. Convert to decimal: 0.5% (half percent)

Work: _____

Answer: _____

15. Meal \$42.00, tax 8.5%, tip 18%. Grand total?

Work: _____

Answer: _____

16. Server earned \$156 in tips on \$780 in sales. Tip percentage?

Work: _____

Answer: _____

17. Calculate 6% tax on \$450.00

Work: _____

Answer: _____

18. Bill \$200. Tax 9%, tip 22%. Total?

Work: _____

Answer: _____

Chapter 1 Action Report: Restaurant Daily Summary Complete

this manager's end-of-day report using ALL your Chapter 1 skills!

Revenue Report

1. Breakfast: \$567.89, Lunch: \$1,234.56, Dinner: \$2,345.67. Total daily revenue?

Work: _____

Answer: _____

2. Round the total revenue to the nearest dollar.

Work: _____

Answer: _____

3. Compare yesterday (\$4,102.50) to today. Which day earned more?

Work: _____

Answer: _____

Food Cost Report

4. Ordered: 35.5 lbs beef at \$6.75/lb. Total cost?

Work: _____

Answer: _____

5. Ordered: 28 lbs chicken at \$4.125/lb. Total cost?

Work: _____

Answer: _____

6. Produce delivery: \$234.56 + \$178.90 + \$145.67. Total?

Work: _____

Answer: _____

Tax and Tip Analysis

7. Table 5 bill: \$145.00. Calculate 8% tax.

Work: _____

Answer: _____

8. Same table left 22% tip on food (before tax). Tip amount?

Work: _____

Answer: _____

9. Total collected from Table 5 (food + tax + tip)?

Work: _____

Answer: _____

10. All tips today: \$567.45. If 15% average, what were total food sales?

Work: _____

Answer: _____

Profit Analysis

11. Total revenue: \$4,148.12. Total expenses: \$1,567.89. Net profit?

Work: _____

Answer: _____

12. Net profit as percentage of revenue? (Round to nearest whole percent)

Work: _____

Answer: _____

CHAPTER 2

The Warehouse Supervisor

Chapter Goal: Master volume calculations to manage shipping and storage efficiently.

You're now the Warehouse Supervisor at a major distribution center. Every day, boxes arrive and ship out. You need to know how much space they take up, how many fit in a truck, and whether packages meet shipping size limits. Volume is your key skill!

Section 1: Filling the Warehouse — Understanding Volume

❖❖ The Scenario

A shipment of boxes arrives. Each box is 2 feet long, 3 feet wide, and 4 feet tall. How much space does one box take up? How many can you fit in a storage bay?

❖❖ The Skill: Volume of Rectangular Prisms

Volume = Length × Width × Height

Volume measures the space inside a 3D shape in cubic units (cubic feet, cubic inches, cubic meters).

❖ Worked Example: Finding Volume of a Box

Box dimensions: $2 \text{ ft} \times 3 \text{ ft} \times 4 \text{ ft}$

Volume = Length × Width × Height

Volume = $2 \times 3 \times 4 = 24$ cubic feet

Answer: 24 cubic feet (also written as 24 ft^3)

❖ Worked Example: Using Volume to Count Boxes

Storage bay: $12 \text{ ft} \times 10 \text{ ft} \times 8 \text{ ft} = 960$ cubic feet

Each box: 24 cubic feet

Maximum boxes = $960 \div 24 = 40$ boxes

Answer: 40 boxes fit in the storage bay

❖ Worked Example: Converting Cubic Inches to Cubic Feet

1 foot = 12 inches

$1 \text{ cubic foot} = 12 \times 12 \times 12 = 1,728$ cubic inches

Box: $3,456 \text{ cubic inches} \div 1,728 = 2$ cubic feet

Answer: $3,456 \text{ in}^3 = 2 \text{ ft}^3$

?? Practice: Volume Calculations

1. Find volume: $5 \text{ ft} \times 4 \text{ ft} \times 3 \text{ ft}$

Work: _____

Answer: _____

2. Find volume: $8 \text{ in} \times 6 \text{ in} \times 10 \text{ in}$

Work: _____

Answer: _____

3. Box is $2 \text{ ft} \times 2 \text{ ft} \times 2 \text{ ft}$. Volume in cubic feet?

Work: _____

Answer: _____

4. Shipping container: $40 \text{ ft} \times 8 \text{ ft} \times 8 \text{ ft}$. Volume?

Work: _____

Answer: _____

5. Find volume: $15 \text{ cm} \times 10 \text{ cm} \times 8 \text{ cm}$

Work: _____

Answer: _____

6. Storage unit: $10 \text{ ft} \times 10 \text{ ft} \times 10 \text{ ft}$. Volume?

Work: _____

Answer: _____

7. Box: $18 \text{ in} \times 12 \text{ in} \times 6 \text{ in}$. Volume in cubic inches?

Work: _____

Answer: _____

8. Truck bed: $20 \text{ ft} \times 8 \text{ ft} \times 6 \text{ ft}$. Volume?

Work: _____

Answer: _____

9. Find volume: $3.5 \text{ ft} \times 2 \text{ ft} \times 4 \text{ ft}$

Work: _____

Answer: _____

10. Crate: $4 \text{ ft} \times 3 \text{ ft} \times 2 \text{ ft}$. How many fit in 240 ft^3 space?

Work: _____

Answer: _____

11. Find volume: $2.5 \text{ m} \times 2 \text{ m} \times 3 \text{ m}$

Work: _____

Answer: _____

12. Package: $12 \text{ in} \times 8 \text{ in} \times 4 \text{ in}$. Volume?

Work: _____

Answer: _____

13. Bay is $1,000 \text{ ft}^3$. Boxes are 25 ft^3 each. How many fit?

Work: _____

Answer: _____

14. Find volume: $6 \text{ ft} \times 4.5 \text{ ft} \times 3 \text{ ft}$

Work: _____

Answer: _____

15. Convert 5,184 cubic inches to cubic feet.

Work: _____

Answer: _____

16. Pallet: $4 \text{ ft} \times 4 \text{ ft} \times 5 \text{ ft}$. Volume?

Work: _____

Answer: _____

Section 2: Shipping Costs — Volume-Based Pricing

Scenario

Shipping companies charge by weight OR by 'dimensional weight' (volume), whichever is greater. A lightweight but bulky package might cost more to ship than a heavy small one!

Worked Example: Dimensional Weight Formula

Dimensional Weight (lbs) = $(L \times W \times H \text{ in inches}) \div 139$

Package: $24 \text{ in} \times 18 \text{ in} \times 12 \text{ in}$

Volume: $24 \times 18 \times 12 = 5,184 \text{ cubic inches}$

Dimensional Weight: $5,184 \div 139 = 37.3 \text{ lbs}$

Answer: Ship uses 37 lbs dimensional weight if actual weight is less

Worked Example: Comparing Actual vs Dimensional Weight

Package weighs 25 lbs, dimensional weight is 37 lbs

Shipping rate: \$0.45 per pound

Use the GREATER weight: 37 lbs

Cost: $37 \times \$0.45 = \16.65

Shipping cost: \$16.65

Worked Example: Calculating Shipping for Multiple Boxes

5 boxes, each 12×12×12 inches, actual weight 15 lbs each

Each box volume: $1,728 \text{ in}^3$; Dim weight: $1,728 \div 139 = 12.4 \text{ lbs}$

Actual (15 lbs) > Dimensional (12.4 lbs), so use 15 lbs

Total: $5 \times 15 \times \$0.50 = \37.50

Shipping cost: \$37.50 for all 5 boxes

Practice: Shipping Calculations

1. Package: 20×16×10 in. Calculate dimensional weight ($\div 139$).

Work: _____

Answer: _____

2. Box weighs 18 lbs. Dim weight is 24 lbs. Which is used for shipping?

Work: _____

Answer: _____

3. Dim weight 30 lbs, rate \$0.55/lb. Shipping cost?

Work: _____

Answer: _____

4. Package: 30×20×15 in. Actual weight 45 lbs. Dim weight? Which is used?

Work: _____

Answer: _____

5. Calculate dim weight: 36×24×18 inches

Work: _____

Answer: _____

6. 8 packages, dim weight 15 lbs each, \$0.48/lb. Total shipping?

Work: _____

Answer: _____

7. Package: $14 \times 14 \times 14$ in. Dim weight?

Work: _____

Answer: _____

8. Box: actual 22 lbs, dim weight 28 lbs, rate \$0.52/lb. Cost?

Work: _____

Answer: _____

9. Calculate dim weight: $48 \times 32 \times 24$ inches

Work: _____

Answer: _____

10. Which costs more to ship? A: 40 lbs actual, or B: $20 \times 20 \times 30$ in (use dim)?

Work: _____

Answer: _____

11. 12 boxes \times dim weight 20 lbs \times \$0.45/lb. Total?

Work: _____

Answer: _____

12. Package: $16 \times 12 \times 8$ in, weighs 12 lbs. Dim weight? Cost at \$0.50/lb?

Work: _____

Answer: _____

Section 3: Packing the Truck — Maximizing Space

❖❖ The Scenario

A delivery truck has limited space. Your job: fit as many boxes as possible without wasting space. This requires dividing the truck's volume strategically.

Worked Example: How Many Boxes Fit?

Truck interior: $16 \text{ ft} \times 8 \text{ ft} \times 7 \text{ ft} = 896 \text{ cubic feet}$

Each box: $2 \text{ ft} \times 2 \text{ ft} \times 2 \text{ ft} = 8 \text{ cubic feet}$

Maximum: $896 \div 8 = 112 \text{ boxes}$

Answer: 112 boxes (if perfectly packed)

Worked Example: Layered Packing

Truck floor: 16 ft \times 8 ft. Box base: 2 ft \times 2 ft

Boxes per row: $16 \div 2 = 8$

Rows: $8 \div 2 = 4$

Boxes per layer: $8 \times 4 = 32$

Layers: $7 \div 2 = 3$ (can't stack partial boxes)

Total: $32 \times 3 = 96$ boxes

Note: Actual fit (96) is less than theoretical max (112) due to height waste

Worked Example: Mixed Box Sizes

Space: 100 cubic feet. Large boxes: 10 ft³. Small boxes: 2 ft³.

Need to ship 5 large boxes = 50 ft³

Remaining: $100 - 50 = 50$ ft³

Small boxes that fit: $50 \div 2 = 25$ small boxes

Answer: 5 large + 25 small boxes

Practice: Packing Efficiency

1. Truck: 20 \times 8 \times 8 ft. Box: 4 \times 4 \times 4 ft. How many fit (theoretical max)?

Work: _____

Answer: _____

2. Container: 1,000 ft³. Each crate: 25 ft³. How many crates?

Work: _____

Answer: _____

3. Truck floor: 20 \times 8 ft. Box base: 2 \times 2 ft. Boxes per layer?

Work: _____

Answer: _____

4. Truck height: 8 ft. Box height: 3 ft. Complete layers possible?

Work: _____

Answer: _____

5. Van: 12 \times 6 \times 6 ft. Boxes: 2 \times 2 \times 2 ft. Maximum boxes?

Work: _____

Answer: _____

6. Space: 500 ft³. Large: 20 ft³ (need 10). Small: 5 ft³. How many small fit after large?

Work: _____

Answer: _____

7. Truck: $24 \times 8 \times 8$ ft. Calculate total volume.

Work: _____

Answer: _____

8. Same truck, boxes: $4 \times 2 \times 2$ ft each. How many fit?

Work: _____

Answer: _____

9. Pallet: $4 \times 4 \times 4$ ft = 64 ft³. Container: $2,560$ ft³. How many pallets?

Work: _____

Answer: _____

10. Floor: 16×8 ft. Box base: 4×2 ft. Boxes per layer?

Work: _____

Answer: _____

11. Truck $1,536$ ft³ holds 64 boxes. Volume per box?

Work: _____

Answer: _____

12. Must ship 100 boxes at 8 ft³ each. Truck is 960 ft³. How many trucks needed?

Work: _____

Answer: _____

Chapter 2 Action Report: Warehouse Daily Operations Complete

this supervisor's shipping report!

Volume Calculations

1. New shipment: 50 boxes, each $3 \times 2 \times 2$ ft. Total volume?

Work: _____

Answer: _____

2. Storage bay: $30 \times 20 \times 12$ ft. Total capacity?

Work: _____

Answer: _____

3. What percentage of the bay will the shipment use?

Work: _____

Answer: _____

Shipping Analysis

4. Package: 24×18×12 in, weighs 20 lbs. Dim weight?

Work: _____

Answer: _____

5. Using dim weight, shipping at \$0.48/lb costs?

Work: _____

Answer: _____

6. 25 packages same size. Total shipping cost?

Work: _____

Answer: _____

Truck Loading

7. Truck: 24×8×9 ft. Volume?

Work: _____

Answer: _____

8. Boxes: 3×2×3 ft. How many fit (theoretical)?

Work: _____

Answer: _____

9. Actually loaded 90 boxes. Capacity used?

Work: _____

Answer: _____

10. Remaining space in cubic feet?

Work: _____

Answer: _____

CHAPTER 3

The Video Game Designer

Chapter Goal: Master the coordinate plane to design game worlds and character movement.

Welcome to the game studio! As a Video Game Designer, you use coordinates to place characters,

objects, and obstacles. Every sprite has a position. Every movement is a coordinate change. Math is the language of game design!

Section 1: The Game Grid — Understanding Coordinates

?? The Scenario

Your game world is a coordinate grid. The center is $(0, 0)$. The player starts there. Every treasure, enemy, and power-up has a location given as (x, y) .

?? The Skill: Reading Coordinates

(x, y) = (horizontal position, vertical position)

- Positive x = right, Negative x = left
- Positive y = up, Negative y = down
- Origin $(0, 0)$ = center of the grid

Worked Example: Plotting a Point

Place the treasure at $(4, 3)$

Step 1: Start at origin $(0, 0)$

Step 2: Move 4 units RIGHT (positive x)

Step 3: Move 3 units UP (positive y)

Location: 4 right, 3 up from center

Worked Example: Reading a Point

An enemy is 5 units left and 2 units down from origin

Left = negative $x \rightarrow x = -5$

Down = negative $y \rightarrow y = -2$

Coordinates: $(-5, -2)$

Worked Example: The Four Quadrants

Quadrant I: $(+, +)$ — upper right

Quadrant II: $(-, +)$ — upper left

Quadrant III: $(-, -)$ — lower left

Quadrant IV: $(+, -)$ — lower right

Example: $(3, -4)$ is in Quadrant IV

?? Practice: Reading and Plotting Coordinates

1. Plot and name the quadrant: $(5, 3)$

Work: _____

Answer: _____

2. Plot and name the quadrant: $(-4, 2)$

Work: _____

Answer: _____

3. Plot and name the quadrant: (-3, -5)

Work: _____

Answer: _____

4. Plot and name the quadrant: (6, -2)

Work: _____

Answer: _____

5. Write coordinates: 7 right, 4 up from origin

Work: _____

Answer: _____

6. Write coordinates: 3 left, 6 down from origin

Work: _____

Answer: _____

7. Which quadrant contains (-8, -1)?

Work: _____

Answer: _____

8. Write coordinates: 5 left, 2 up from origin

Work: _____

Answer: _____

9. What are the coordinates of the origin?

Work: _____

Answer: _____

10. Plot: (0, 5). What axis is this point on?

Work: _____

Answer: _____

11. Plot: (-4, 0). What axis is this point on?

Work: _____

Answer: _____

12. Write coordinates: 9 right, 7 down from origin

Work: _____

Answer: _____

13. Which quadrant contains (100, 50)?

Work: _____

Answer: _____

14. Player at (-2, 4). Describe position in words.

Work: _____

Answer: _____

15. Enemy at (0, -6). Describe position in words.

Work: _____

Answer: _____

16. Power-up is 8 left, 3 up. Write coordinates.

Work: _____

Answer: _____

Section 2: Character Movement — Coordinate Changes

?? The Scenario

Your character moves across the screen. Each arrow key changes the coordinates. Right adds to x. Up adds to y. Track where the player ends up!

Worked Example: Moving a Character

Player starts at (2, 3)

Moves: Right 4, Up 2

New x: $2 + 4 = 6$

New y: $3 + 2 = 5$

New position: (6, 5)

Worked Example: Negative Movement

Player at (5, 4). Moves: Left 7, Down 6

Left = subtract from x: $5 - 7 = -2$

Down = subtract from y: $4 - 6 = -2$

New position: (-2, -2)

Worked Example: Finding the Movement

Character went from (1, 2) to (7, 5)

Horizontal change: $7 - 1 = 6$ (moved 6 right)

Vertical change: $5 - 2 = 3$ (moved 3 up)

Movement: Right 6, Up 3

Worked Example: Distance Between Points (Horizontal/Vertical) Treasure

at (8, 3), Player at (2, 3)

Same y-coordinate → horizontal distance

Distance: $|8 - 2| = 6$ units

Distance: 6 units apart

Practice: Movement Calculations

1. Start (3, 2). Move right 5, up 4. New position?

Work: _____

Answer: _____

2. Start (0, 0). Move left 3, down 7. New position?

Work: _____

Answer: _____

3. Start (-4, 5). Move right 10, down 8. New position?

Work: _____

Answer: _____

4. Start (6, -2). Move left 4, up 6. New position?

Work: _____

Answer: _____

5. Went from (2, 1) to (8, 1). Describe the movement.

Work: _____

Answer: _____

6. Went from (5, 7) to (5, 2). Describe the movement.

Work: _____

Answer: _____

7. Went from (-3, 4) to (4, -2). Horizontal change? Vertical change?

Work: _____

Answer: _____

8. Distance between (0, 0) and (0, 9)?

Work: _____

Answer: _____

9. Distance between (4, 5) and (10, 5)?

Work: _____

Answer: _____

10. Start (8, 8). Move left 12, down 12. New position?

Work: _____

Answer: _____

11. Player needs to reach (7, 3) from (2, 8). What moves?

Work: _____

Answer: _____

12. Went from (10, 10) to (3, 4). Total horizontal + vertical change?

Work: _____

Answer: _____

13. Start (-5, -5). Move right 5, up 5. New position?

Work: _____

Answer: _____

14. Distance between (-3, 0) and (6, 0)?

Work: _____

Answer: _____

15. Start (0, 4). After moving, now at (-6, -3). What was the movement?

Work: _____

Answer: _____

16. Character makes 4 moves: Right 3, Up 2, Left 5, Down 4. Starting from origin, final position?

Work: _____

Answer: _____

Section 3: Game Objects — Shapes and Boundaries

?? The Scenario

Game objects have boundaries. A power-up zone might be a rectangle from (2, 1) to (6, 4). You need to know if the player is inside the zone!

✍ Worked Example: Drawing a Rectangle

Rectangle with corners at (1, 1), (5, 1), (5, 4), (1, 4)

Width: $5 - 1 = 4$ units

Height: $4 - 1 = 3$ units

Dimensions: 4 units wide \times 3 units tall

✍ Worked Example: Is the Player in the Zone?

Safe zone: x from 2 to 8, y from 1 to 5

Player at (6, 3)

Is $2 \leq 6 \leq 8$? Yes

Is $1 \leq 3 \leq 5$? Yes

Answer: Player IS in the safe zone

✍ Worked Example: Perimeter of Game Boundary

Boundary corners: (0, 0), (10, 0), (10, 8), (0, 8)

Width: 10 units, Height: 8 units

Perimeter: $2(10) + 2(8) = 36$ units

Boundary perimeter: 36 units

❖❖ Practice: Shapes and Boundaries

1. Rectangle corners: (2, 3), (7, 3), (7, 6), (2, 6). Width? Height?

Work: _____

Answer: _____

2. Square corners: (0, 0), (5, 0), (5, 5), (0, 5). Side length? Perimeter?

Work: _____

Answer: _____

3. Zone: x from 3 to 9, y from 2 to 7. Is (5, 4) inside?

Work: _____

Answer: _____

4. Zone: x from -4 to 4, y from -3 to 3. Is (5, 2) inside?

Work: _____

Answer: _____

5. Rectangle corners at (1, 1), (8, 1), (8, 5), (1, 5). Area?

Work: _____

Answer: _____

6. Draw rectangle with width 6 starting at (2, 3) going right and up 4. List all 4 corners.

Work: _____

Answer: _____

7. Danger zone: x from -10 to -2, y from 0 to 6. Is (-5, 3) in danger?

Work: _____

Answer: _____

8. Safe zone: x from 0 to 20, y from 0 to 15. Area of safe zone?

Work: _____

Answer: _____

9. Rectangle: (3, 2) to (9, 8). Perimeter?

Work: _____

Answer: _____

10. Player must stay in x: 5 to 15, y: 10 to 20. Player at (12, 22). Safe?

Work: _____

Answer: _____

11. Enemy patrol area: corners (0, 0), (6, 0), (6, 4), (0, 4). Area?

Work: _____

Answer: _____

12. Two zones: Zone A (0,0) to (5,5), Zone B (4,4) to (9,9). Do they overlap?

Work: _____

Answer: _____

Chapter 3 Action Report: Game Level Design

Design a complete game level using coordinates!

Place Game Objects

1. Player spawn point: 3 right, 2 up from origin. Coordinates?

Work: _____

Answer: _____

2. Enemy 1 at (-5, 4). Enemy 2 at (5, 4). Distance between them?

Work: _____

Answer: _____

3. Treasure in Quadrant III, 6 left and 3 down. Coordinates?

Work: _____

Answer: _____

Movement Sequences

4. Player starts (0, 0). Moves: Right 4, Up 3, Left 2, Up 2. Final position?

Work: _____

Answer: _____

5. To reach treasure at (8, 7) from current (3, 2), what moves needed?

Work: _____

Answer: _____

6. Player at (-4, -4) needs to reach origin. Shortest moves?

Work: _____

Answer: _____

Level Boundaries

7. Play area: corners at (-10, -8), (10, -8), (10, 8), (-10, 8). Width? Height?

Work: _____

Answer: _____

8. Same play area. Total area in square units?

Work: _____

Answer: _____

9. Safe zone: x from -5 to 5, y from -4 to 4. Is player at (6, 3) safe?

Work: _____

Answer: _____

10. Boss arena: rectangle from (15, 10) to (25, 18). Area of arena?

Work: _____

Answer: _____

CHAPTER 4

The Catering Chef

Chapter Goal: Master fraction operations to scale recipes for events of any size.

You're the head chef for a catering company. Today's challenge: a wedding with 150 guests, a corporate lunch for 45, and a birthday party for 20. Your base recipes serve 8. Time to scale up and down using fractions!

Section 1: Combining Ingredients — Unlike Denominators

❖❖ The Scenario

Your cake recipe needs $\frac{2}{3}$ cup of butter and $\frac{3}{4}$ cup of oil. How much total fat? The denominators are different, so you can't just add the numerators. You need a common denominator!

❖ Worked Example: Finding the LCD

Add: $\frac{2}{3} + \frac{3}{4}$

Step 1: Find Least Common Denominator (LCD)

Multiples of 3: 3, 6, 9, 12, 15...

Multiples of 4: 4, 8, 12, 16...

LCD = 12

Result: Use 12 as common denominator

❖ Worked Example: Converting and Adding

$\frac{2}{3} + \frac{3}{4} = ?/12 + ?/12$

$\frac{2}{3} = 8/12$ (multiply top and bottom by 4)

$\frac{3}{4} = 9/12$ (multiply top and bottom by 3)

$8/12 + 9/12 = 17/12 = 1 \frac{5}{12}$

Answer: $1 \frac{5}{12}$ cups of fat total

Worked Example: Adding Three Fractions

$$\frac{1}{2} + \frac{1}{3} + \frac{1}{4} = ?$$

LCD of 2, 3, 4 = 12

$$\frac{1}{2} = \frac{6}{12}, \frac{1}{3} = \frac{4}{12}, \frac{1}{4} = \frac{3}{12}$$

$$\frac{6}{12} + \frac{4}{12} + \frac{3}{12} = \frac{13}{12} = 1 \frac{1}{12}$$

Answer: $1 \frac{1}{12}$

Worked Example: Adding Mixed Numbers with Unlike Denominators $2 \frac{1}{3} + 1$

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

Add whole numbers: $2 + 1 = 3$

$$\text{Add fractions: } \frac{1}{3} + \frac{3}{4} = \frac{4}{12} + \frac{9}{12} = \frac{13}{12} = 1 \frac{1}{12}$$

$$\text{Combine: } 3 + 1 \frac{1}{12} = 4 \frac{1}{12}$$

Answer: $4 \frac{1}{12}$

Practice: Adding Fractions with Unlike Denominators

1. Add: $\frac{1}{2} + \frac{1}{3}$

Work: _____

Answer: _____

2. Add: $\frac{2}{3} + \frac{1}{4}$

Work: _____

Answer: _____

3. Add: $\frac{3}{4} + \frac{2}{5}$

Work: _____

Answer: _____

4. Add: $\frac{1}{6} + \frac{1}{4}$

Work: _____

Answer: _____

5. Add: $\frac{2}{5} + \frac{1}{2}$

Work: _____

Answer: _____

6. Add: $\frac{3}{8} + \frac{1}{4}$

Work: _____

Answer: _____

7. Add: $1/2 + 1/4 + 1/8$

Work: _____

Answer: _____

8. Add: $2/3 + 1/6 + 1/2$

Work: _____

Answer: _____

9. Add: $1 \frac{1}{2} + 2 \frac{1}{3}$

Work: _____

Answer: _____

10. Add: $2 \frac{2}{3} + 1 \frac{3}{4}$

Work: _____

Answer: _____

11. Recipe: $1/2$ cup butter + $2/3$ cup oil. Total fat?

Work: _____

Answer: _____

12. Add: $3/5 + 2/3$

Work: _____

Answer: _____

13. Add: $4/5 + 3/4$

Work: _____

Answer: _____

14. Add: $2 \frac{1}{4} + 3 \frac{2}{3}$

Work: _____

Answer: _____

15. Add: $1/3 + 1/4 + 1/6$

Work: _____

Answer: _____

16. Ingredients: $\frac{3}{4}$ cup + $\frac{2}{3}$ cup + $\frac{1}{2}$ cup. Total?

Work: _____

Answer: _____

Section 2: Adjusting Portions — Subtracting Fractions

— The Scenario

You have $2 \frac{1}{2}$ cups of flour but the recipe only needs $1 \frac{3}{4}$ cups. How much will be left over? Subtracting fractions requires the same common denominator technique.

✍ Worked Example: Subtracting Unlike Denominators

$$\frac{3}{4} - \frac{1}{3} = ?$$

$$\text{LCD} = 12$$

$$\frac{3}{4} = \frac{9}{12}, \frac{1}{3} = \frac{4}{12}$$

$$\frac{9}{12} - \frac{4}{12} = \frac{5}{12}$$

Answer: $\frac{5}{12}$

✍ Worked Example: Subtracting Mixed Numbers

$$2 \frac{1}{2} - 1 \frac{3}{4} = ?$$

$$\text{Convert to LCD (4): } 2 \frac{2}{4} - 1 \frac{3}{4}$$

$$\text{Need to borrow: } 2 \frac{2}{4} = 1 \frac{6}{4}$$

$$1 \frac{6}{4} - 1 \frac{3}{4} = \frac{3}{4}$$

Answer: $\frac{3}{4}$ cup left over

✍ Worked Example: Subtracting from a Whole Number $3 - \frac{2}{5}$

$$= ?$$

$$3 = 2 \frac{5}{5}$$

$$2 \frac{5}{5} - \frac{2}{5} = 2 \frac{3}{5}$$

Answer: $2 \frac{3}{5}$

❖❖ Practice: Subtracting Fractions

1. Subtract: $\frac{3}{4} - \frac{1}{2}$

Work: _____

Answer: _____

2. Subtract: $\frac{5}{6} - \frac{1}{3}$

Work: _____

Answer: _____

3. Subtract: $2/3 - 1/4$

Work: _____

Answer: _____

4. Subtract: $7/8 - 1/2$

Work: _____

Answer: _____

5. Subtract: $4/5 - 2/3$

Work: _____

Answer: _____

6. Subtract: $2 - 3/4$

Work: _____

Answer: _____

7. Subtract: $3 - 1 \frac{1}{3}$

Work: _____

Answer: _____

8. Subtract: $2 \frac{1}{2} - 1 \frac{2}{3}$

Work: _____

Answer: _____

9. Subtract: $4 \frac{1}{4} - 2 \frac{1}{2}$

Work: _____

Answer: _____

10. Subtract: $5 \frac{1}{3} - 2 \frac{3}{4}$

Work: _____

Answer: _____

11. Have 3 cups flour, need $2 \frac{1}{3}$ cups. Remaining?

Work: _____

Answer: _____

12. Subtract: $7/10 - 2/5$

Work: _____

Answer: _____

13. Subtract: $5/6 - 3/8$

Work: _____

Answer: _____

14. Subtract: $6 - 2 \frac{2}{5}$

Work: _____

Answer: _____

15. Subtract: $3 \frac{1}{6} - 1 \frac{3}{4}$

Work: _____

Answer: _____

16. Had $4 \frac{1}{2}$ lbs meat, used $2 \frac{5}{8}$ lbs. Remaining?

Work: _____

Answer: _____

Section 3: Scaling Recipes — Multiplying Fractions

✖ The Scenario

Your recipe serves 8, but you need to serve 20. That's $20/8 = 2 \frac{1}{2}$ times the recipe. If the original calls for $\frac{2}{3}$ cup sugar, how much do you need now?

⚡ Worked Example: Multiplying Fractions

$$\frac{2}{3} \times 2 \frac{1}{2} = ?$$

Convert mixed to improper: $2 \frac{1}{2} = \frac{5}{2}$

$$\text{Multiply: } \frac{2}{3} \times \frac{5}{2} = \frac{10}{6} = \frac{5}{3} = 1 \frac{2}{3}$$

Answer: $1 \frac{2}{3}$ cups sugar needed

⚡ Worked Example: Multiplying a Whole Number by a Fraction

Triple the recipe: $3 \times \frac{3}{4}$ cup = ?

$$\frac{3}{1} \times \frac{3}{4} = \frac{9}{4} = 2 \frac{1}{4}$$

Answer: $2 \frac{1}{4}$ cups

 **Worked Example: Finding a Fraction of a Fraction**

Use $1/2$ of the $2/3$ cup you have

$$1/2 \times 2/3 = 2/6 = 1/3$$

Answer: $1/3$ cup

 **Worked Example: Scaling Down**

Recipe serves 8, need to serve 4. Scale factor: $4/8 = 1/2$

Original: 2 cups flour. New: $2 \times 1/2 = 1$ cup

Answer: Use 1 cup flour for half recipe

  **Practice: Multiplying Fractions**

1. Multiply: $1/2 \times 3/4$

Work: _____

Answer: _____

2. Multiply: $2/3 \times 3/5$

Work: _____

Answer: _____

3. Multiply: $4 \times 2/3$

Work: _____

Answer: _____

4. Multiply: $1/4 \times 2/5$

Work: _____

Answer: _____

5. Multiply: $5/6 \times 3/4$

Work: _____

Answer: _____

6. Triple: $2/3$ cup \times 3

Work: _____

Answer: _____

7. Multiply: $2 \frac{1}{2} \times 1/3$

Work: _____

Answer: _____

8. Multiply: $1\frac{3}{4} \times 2\frac{5}{6}$

Work: _____

Answer: _____

9. Scale recipe $\times 1.5$: $\frac{2}{3}$ cup $\times \frac{3}{2}$

Work: _____

Answer: _____

10. Half recipe: $\frac{3}{4}$ cup $\times \frac{1}{2}$

Work: _____

Answer: _____

11. Recipe $\times 4$: $1\frac{1}{2}$ cups $\times 4$

Work: _____

Answer: _____

12. Multiply: $\frac{3}{8} \times \frac{2}{3}$

Work: _____

Answer: _____

13. Multiply: $5 \times \frac{3}{10}$

Work: _____

Answer: _____

14. Multiply: $2\frac{2}{3} \times \frac{3}{4}$

Work: _____

Answer: _____

15. Quarter recipe: 2 cups $\times \frac{1}{4}$

Work: _____

Answer: _____

16. Scale $\times 2.5$: $\frac{3}{4}$ cup $\times \frac{5}{2}$

Work: _____

Answer: _____

Chapter 4 Action Report: Wedding Catering

Plan the food for a 150-person wedding!

Recipe Scaling

1. Base recipe serves 8. Wedding has 150 guests. Scale factor as a fraction?

Work: _____

Answer: _____

2. Simplify: $150/8$ as a mixed number

Work: _____

Answer: _____

3. Recipe needs $2/3$ cup butter. Scaled amount needed?

Work: _____

Answer: _____

Ingredient Totals

4. Appetizers: $1/4$ lb cheese per person. Total cheese for 150?

Work: _____

Answer: _____

5. Main course needs: $2 \frac{1}{3}$ cups sauce base, $1 \frac{3}{4}$ cups cream. Total liquid?

Work: _____

Answer: _____

6. Dessert: $\frac{3}{4}$ cup sugar + $\frac{2}{3}$ cup flour + $\frac{1}{2}$ cup butter. Total dry + wet?

Work: _____

Answer: _____

Leftover Calculations

7. Bought 40 lbs flour, used $37 \frac{2}{3}$ lbs. Remaining?

Work: _____

Answer: _____

8. Had 25 gallons milk, used $22 \frac{5}{8}$ gallons. Left over?

Work: _____

Answer: _____

9. Ordered 50 lbs of beef. Used 3/4 of it. Pounds used? Pounds remaining?

Work: _____

Answer: _____

10. Budget was \$2,500. Spent 7/8 of budget. Amount spent? Amount remaining?

Work: _____

Answer: _____

CHAPTER 5

The Landscaping Contractor

Chapter Goal: Calculate areas of complex shapes and convert measurements for professional landscaping projects.

You run a landscaping company. Today's project: design and install a backyard makeover including a patio, garden beds, lawn area, and walkways. Accurate measurements mean accurate bids—and profit!

Section 1: Irregular Yards — Breaking Down Complex Shapes

❖ The Scenario

Most yards aren't simple rectangles. An L-shaped lawn, a patio with a cutout for a tree, gardens with curved edges approximated as shapes—you need to break these into simpler pieces.

❖ Worked Example: L-Shaped Lawn

Yard is L-shaped: Main section 40×30 ft, extension 20×15 ft

Area = Rectangle 1 + Rectangle 2

$$= (40 \times 30) + (20 \times 15)$$

$$= 1,200 + 300 = 1,500 \text{ sq ft}$$

Answer: 1,500 square feet of lawn

❖ Worked Example: Patio with Cutout

Patio: 20×15 ft with 4×4 ft tree cutout

Full rectangle: $20 \times 15 = 300 \text{ sq ft}$

Cutout: $4 \times 4 = 16 \text{ sq ft}$

Actual patio: $300 - 16 = 284 \text{ sq ft}$

Answer: 284 square feet of patio

❖ Worked Example: Multiple Garden Beds

Three rectangular beds: 8×4, 10×3, 6×5 ft

Bed 1: $8 \times 4 = 32 \text{ sq ft}$

Bed 2: $10 \times 3 = 30 \text{ sq ft}$

Bed 3: $6 \times 5 = 30 \text{ sq ft}$

Total: $32 + 30 + 30 = 92 \text{ sq ft}$

Answer: 92 square feet of garden beds

 **Worked Example: Finding Remaining Lawn Area**

Total yard: $50 \times 40 = 2,000$ sq ft

Patio: 284 sq ft, Gardens: 92 sq ft, Walkway: 45 sq ft

Features total: $284 + 92 + 45 = 421$ sq ft

Lawn: $2,000 - 421 = 1,579$ sq ft

Answer: 1,579 square feet of lawn

 **Practice: Complex Area Calculations**

1. L-shaped: 30×20 ft main + 15×10 ft extension. Total area?

Work: _____

Answer: _____

2. Rectangle 25×18 ft with 5×5 ft cutout. Area?

Work: _____

Answer: _____

3. Three beds: 12×4 , 8×6 , 10×5 ft. Total area?

Work: _____

Answer: _____

4. Yard 60×45 ft. Patio 15×12 ft. Remaining lawn?

Work: _____

Answer: _____

5. U-shaped patio: main 20×10 , two extensions each 8×10 . Total?

Work: _____

Answer: _____

6. Pool area: 30×20 ft rectangle minus 15×10 ft pool. Deck area?

Work: _____

Answer: _____

7. Two L-shapes combined: each is $20 \times 15 + 10 \times 8$. Total?

Work: _____

Answer: _____

8. Yard: 2,500 sq ft. Subtract: patio 200, gardens 150, shed 80. Lawn?

Work: _____

Answer: _____

9. T-shaped walkway: stem 15×3 ft, top 12×3 ft. Total area?

Work: _____

Answer: _____

10. Rectangle 40×25 with two cutouts: 6×6 and 8×4. Remaining area?

Work: _____

Answer: _____

11. Border: outer 50×40, inner 46×36. Border area only?

Work: _____

Answer: _____

12. Four identical flower beds, each 6×4 ft. Total bed area?

Work: _____

Answer: _____

Section 2: Borders and Fences — Perimeter Calculations

❖❖ The Scenario

Edging around garden beds, fencing around yards, borders around patios—all require perimeter calculations. And complex shapes have longer perimeters than you might expect!

✎ Worked Example: Perimeter of L-Shaped Garden

L-shape: 20 ft, turns left 10 ft, goes 12 ft, turns left 8 ft, connects back

Add all outer edges: $20 + 10 + 12 + 8 + 8 + 18 = 76$ ft

(Draw it out to find all sides!)

Answer: 76 feet of edging needed

✎ Worked Example: Fencing with a Gate Opening

Rectangular yard: 80×60 ft. Gate is 4 ft wide.

Full perimeter: $2(80) + 2(60) = 280$ ft

Minus gate: $280 - 4 = 276$ ft

Answer: 276 feet of fencing needed

 **Worked Example: Multiple Beds, Multiple Borders**

Three beds: 8×4 , 10×3 , 6×5 ft

Bed 1 perimeter: $2(8) + 2(4) = 24$ ft

Bed 2 perimeter: $2(10) + 2(3) = 26$ ft

Bed 3 perimeter: $2(6) + 2(5) = 22$ ft

Total edging: $24 + 26 + 22 = 72$ ft

Answer: 72 feet of edging for all beds

 **Practice: Perimeter Calculations**

1. Rectangle 45×30 ft. Perimeter?

Work: _____

Answer: _____

2. Square garden, side 12 ft. Perimeter?

Work: _____

Answer: _____

3. Fence 60×40 yard with 3 ft gate. Fence needed?

Work: _____

Answer: _____

4. Four beds: 10×4 , 8×5 , 12×3 , 6×6 . Total edging?

Work: _____

Answer: _____

5. L-shaped bed: 15 ft, 8 ft, 9 ft, 4 ft, 6 ft, 12 ft. Perimeter?

Work: _____

Answer: _____

6. Circular approximation: 8-sided shape, each side 4 ft. Perimeter?

Work: _____

Answer: _____

7. Border around 20×15 pool, border is 3 ft wide. Outer perimeter?

Work: _____

Answer: _____

8. Three identical square beds, side 5 ft each. Total edging?

Work: _____

Answer: _____

9. Yard 100×75 ft. Two gates, each 4 ft. Fence needed?

Work: _____

Answer: _____

10. Patio 18×14 ft with decorative border. Linear feet of border?

Work: _____

Answer: _____

11. Rectangle 50×35 ft minus 10×10 cutout. Perimeter of remaining shape?

Work: _____

Answer: _____

12. U-shaped garden: outer dims 24×16 ft, inner cutout 12×8 ft. Perimeter?

Work: _____

Answer: _____

Section 3: Ordering Materials — Area to Quantity

❖ The Scenario

You know the area. Now you need to order materials: sod by the pallet, mulch by the cubic yard, pavers by the square foot. Converting area to material quantity is where profit is made or lost!

❖ Worked Example: Sod Coverage

Lawn area: 1,500 sq ft. Sod pallets cover 450 sq ft each.

Pallets needed: $1,500 \div 450 = 3.33$

Round UP (can't buy partial pallets): 4 pallets

Cost at \$180/pallet: $4 \times \$180 = \720

Order: 4 pallets, \$720

❖ Worked Example: Mulch by Cubic Yard

Garden beds: 92 sq ft. Mulch depth: 3 inches = 0.25 ft

Volume: $92 \times 0.25 = 23$ cubic feet

Convert: $23 \div 27 = 0.85$ cubic yards (27 cu ft per cu yd)

Round up: 1 cubic yard

Order: 1 cubic yard of mulch

 **Worked Example: Pavers with Waste Factor**

Patio: 284 sq ft. Add 10% for cuts/waste.

$$284 \times 1.10 = 312.4 \text{ sq ft}$$

Pavers: 4 sq ft each. Quantity: $312.4 \div 4 = 78.1$

Round up: 79 pavers

Order: 79 pavers

 **Practice: Material Calculations**

1. Lawn 2,000 sq ft. Sod pallets cover 500 sq ft. How many pallets?

Work: _____

Answer: _____

2. Same lawn. Pallets cost \$200 each. Total cost?

Work: _____

Answer: _____

3. Garden 150 sq ft, mulch 4 in deep. Volume in cubic feet?

Work: _____

Answer: _____

4. Convert 54 cubic feet to cubic yards.

Work: _____

Answer: _____

5. Patio 320 sq ft + 10% waste. Pavers are 2 sq ft each. How many?

Work: _____

Answer: _____

6. Edging 72 ft. Pieces are 8 ft long. How many pieces?

Work: _____

Answer: _____

7. Gravel path: 45 sq ft \times 2 in deep. Volume in cubic feet?

Work: _____

Answer: _____

8. Fence 276 ft. Panels are 8 ft wide. How many panels?

Work: _____

Answer: _____

9. Seed covers 1,000 sq ft per bag. Lawn is 3,500 sq ft. Bags needed?

Work: _____

Answer: _____

10. Mulch: \$45 per cubic yard. Need 3.5 cu yd (round up). Cost?

Work: _____

Answer: _____

11. Pavers: \$3.50 each. Need 79 pavers. Material cost?

Work: _____

Answer: _____

12. Total project: sod \$720, mulch \$180, pavers \$277. Grand total?

Work: _____

Answer: _____

Chapter 5 Action Report: Backyard Makeover Bid Create a complete materials bid for a backyard project!

Area Calculations

1. Yard: 60×45 ft. Total area?

Work: _____

Answer: _____

2. Patio: 18×15 ft with 3×3 tree cutout. Patio area?

Work: _____

Answer: _____

3. Three garden beds: 10×4, 8×6, 12×5 ft. Total bed area?

Work: _____

Answer: _____

4. Remaining lawn area after patio and beds?

Work: _____

Answer: _____

Perimeter Calculations

5. Fence entire yard with one 4 ft gate. Fence length?

Work: _____

Answer: _____

6. Edging around all three garden beds. Total edging?

Work: _____

Answer: _____

7. Patio border (outer edge only). Length?

Work: _____

Answer: _____

Material Order

8. Sod for lawn. Pallets cover 400 sq ft. Pallets needed?

Work: _____

Answer: _____

9. Mulch for beds, 3 in deep. Cubic yards needed? (Round up)

Work: _____

Answer: _____

10. Pavers for patio + 10% waste. Each paver is 1 sq ft. Quantity?

Work: _____

Answer: _____

CHAPTER 6

The Sports Analyst

Chapter Goal: Master advanced statistics to analyze team performance and make predictions.

You've been hired as the data analyst for a professional sports team. The coach wants to know: Who's the most consistent player? Is our scoring improving? What should we expect next game? Statistics tell the story!

Section 1: Player Performance — Mean, Median, Mode

❖❖ The Scenario

A player scored these points in 7 games: 12, 18, 15, 22, 15, 28, and 15. What's their average? What score appears most? What's the middle value? Each measure tells you something different.

❖ Worked Example: Finding the Mean (Average)

Scores: 12, 18, 15, 22, 15, 28, 15

Step 1: Add all values: $12+18+15+22+15+28+15 = 125$

Step 2: Count values: 7 games

Step 3: Divide: $125 \div 7 = 17.86$

Mean: 17.86 points per game (round to 17.9)

❖ Worked Example: Finding the Median (Middle Value)

First, order the data: 12, 15, 15, 15, 18, 22, 28

Count: 7 values (odd number)

Middle position: $(7+1) \div 2 = 4$ th value

The 4th value is 15.

Median: 15 points

❖ Worked Example: Finding the Mode (Most Frequent)

Scores: 12, 15, 15, 15, 18, 22, 28

Count each: 12(1), 15(3), 18(1), 22(1), 28(1)

15 appears most often (3 times)

Mode: 15 points

❖ Worked Example: Median with Even Number of Values

Scores: 10, 14, 18, 22, 26, 30 (6 values)

Middle positions: 3rd and 4th values

Values: 18 and 22

Median = $(18 + 22) \div 2 = 20$

Median: 20

  **Practice: Mean, Median, Mode**

1. Find mean: 8, 12, 15, 9, 11

Work: _____

Answer: _____

2. Find median: 23, 45, 67, 34, 56

Work: _____

Answer: _____

3. Find mode: 5, 8, 5, 9, 5, 8, 7

Work: _____

Answer: _____

4. Scores: 14, 18, 22, 16, 20. Find mean.

Work: _____

Answer: _____

5. Scores: 88, 92, 75, 84, 96, 88. Find median.

Work: _____

Answer: _____

6. Find all three (mean, median, mode): 10, 15, 10, 20, 10, 25

Work: _____

Answer: _____

7. Points: 24, 18, 30, 22, 26. Mean?

Work: _____

Answer: _____

8. Rebounds: 8, 12, 8, 10, 8, 14, 8. Mode?

Work: _____

Answer: _____

9. Assists: 5, 7, 9, 11, 13. Median?

Work: _____

Answer: _____

10. Scores: 100, 85, 92, 88, 95, 90, 85. Find mean and mode.

Work: _____

Answer: _____

11. Six games: 15, 18, 21, 24, 27, 30. Median?

Work: _____

Answer: _____

12. Data: 45, 50, 55, 50, 45, 50. Find mode.

Work: _____

Answer: _____

13. Team scores: 78, 82, 75, 90, 85. Mean?

Work: _____

Answer: _____

14. Eight values: 3, 5, 7, 9, 11, 13, 15, 17. Median?

Work: _____

Answer: _____

15. Goals: 2, 0, 3, 1, 2, 4, 2, 1. Find mean and mode.

Work: _____

Answer: _____

16. If mean of 5 numbers is 20, what's the sum of all 5?

Work: _____

Answer: _____

Section 2: Consistency Check — Range and Outliers

❖❖ The Scenario

Two players both average 20 points. But Player A scores between 18-22 every game, while Player B swings from 8 to 35. Who's more consistent? Range tells you!

❖ Worked Example: Finding the Range

Player A scores: 18, 20, 22, 19, 21

Range = Highest - Lowest = $22 - 18 = 4$

Range: 4 points (very consistent)

Worked Example: Comparing Consistency

Player A: Range = 4 (scores 18-22)

Player B scores: 8, 15, 25, 35, 17. Range = $35 - 8 = 27$

Player A has smaller range = more consistent

Analysis: Player A is more reliable

Worked Example: Identifying Outliers

Team scores: 72, 75, 78, 74, 45, 76, 73

Most scores cluster around 72-78

45 is much lower than the rest—it's an outlier

Without outlier, mean = 74.7. With outlier, mean = 70.4

Impact: One bad game dropped average by 4.3 points

❖❖ Practice: Range and Data Analysis

1. Find range: 45, 52, 48, 67, 51

Work: _____

Answer: _____

2. Find range: 88, 92, 85, 90, 87

Work: _____

Answer: _____

3. Scores: 12, 15, 18, 45, 14, 16. Identify the outlier.

Work: _____

Answer: _____

4. Player A range: 8. Player B range: 22. Who's more consistent?

Work: _____

Answer: _____

5. Find range: 100, 95, 102, 98, 97, 103

Work: _____

Answer: _____

6. Data: 25, 28, 26, 27, 5, 29. Find range with and without outlier.

Work: _____

Answer: _____

7. Rebounds: 8, 10, 9, 11, 8, 35. Outlier? Range without it?

Work: _____

Answer: _____

8. Which set is more consistent? A: 50,52,48,51 or B: 30,70,45,55

Work: _____

Answer: _____

9. Find range: 3.5, 4.2, 3.8, 4.0, 3.9

Work: _____

Answer: _____

10. Scores: 78, 82, 80, 15, 79, 81. Mean with outlier? Without?

Work: _____

Answer: _____

11. Assists: 5, 7, 6, 8, 5, 7, 6. Range?

Work: _____

Answer: _____

12. Game times (min): 45, 48, 52, 47, 90, 46. Outlier? Adjusted range?

Work: _____

Answer: _____

Section 3: Future Performance — Using Data to Predict

❖ The Scenario

Based on past performance, what should we expect in future games? If a player averages 18 points, we can predict they'll score around 18 next game. Projections help with planning!

❖ Worked Example: Predicting Season Totals

Player averaged 22 points in first 10 games

Season has 82 games

Predicted total: $22 \times 82 = 1,804$ points

Projection: 1,804 points for the season

❖ Worked Example: Predicting Team Wins

Team won 12 of first 20 games = 60% win rate

Season has 82 games

Predicted wins: $0.60 \times 82 = 49.2 \approx 49$ wins

Projection: About 49 wins this season

Worked Example: What Score is Needed?

Player wants 20-point average after 5 games

Current scores: 18, 22, 16, 24. Sum = 80

Need: $20 \times 5 = 100$ total points

Must score: $100 - 80 = 20$ points in game 5

Target: 20 points needed

Practice: Predictions and Projections

1. Player averages 15 points. Predict total for 50-game season.

Work: _____

Answer: _____

2. Team wins 70% of games. In 80-game season, predicted wins?

Work: _____

Answer: _____

3. Scores: 22, 18, 24. What's needed in game 4 for 22 average?

Work: _____

Answer: _____

4. Player averages 8 rebounds in 15 games. Season projection for 82 games?

Work: _____

Answer: _____

5. Team scored 450 points in 5 games. Average? 20-game projection?

Work: _____

Answer: _____

6. Win rate 55%. Predict wins out of next 40 games.

Work: _____

Answer: _____

7. Current average: 12 assists. Need 15 average after 4 games. Game 4 target?

Work: _____

Answer: _____

8. First 10 games: 180 points total. Next 10 games predict?

Work: _____

Answer: _____

9. Scores: 25, 30, 20, 15. Need 24 average after 5 games. Game 5 need?

Work: _____

Answer: _____

10. Team averages 95 points/game. Predict 82-game season total.

Work: _____

Answer: _____

11. Player shoots 80% free throws. Predict makes out of next 50 attempts.

Work: _____

Answer: _____

12. First half average: 18 pts. Second half goal: 22 average. What total needed?

Work: _____

Answer: _____

Chapter 6 Action Report: Season Analysis

Analyze this player's performance data!

Games 1-8 scores: 22, 18, 25, 15, 28, 20, 22, 30

Statistical Analysis

1. Calculate the mean score.

Work: _____

Answer: _____

2. Find the median score.

Work: _____

Answer: _____

3. Find the mode (if any).

Work: _____

Answer: _____

4. Calculate the range.

Work: _____

Answer: _____

Consistency and Outliers

5. Is the player consistent? Explain using range.

Work: _____

Answer: _____

6. Are there any outliers? If yes, which?

Work: _____

Answer: _____

7. Recalculate mean without the lowest score.

Work: _____

Answer: _____

Projections

8. Based on current average, predict 82-game season total.

Work: _____

Answer: _____

9. Player wants 25 average. What must they score in game 9?

Work: _____

Answer: _____

10. If scoring continues at this rate, will player reach 2,000 season points?

Work: _____

Answer: _____

CHAPTER 7

The Travel Agent

Chapter Goal: Master time zones, elapsed time, and large number calculations for global travel planning.

Welcome to the travel agency! Clients want trips across the country and around the world. You'll calculate flight times across time zones, figure out arrival times, and work with prices in the thousands and tens of thousands. Let's plan some trips!

Section 1: Around the World — Time Zone Calculations

?? The Scenario

A client in New York wants to call their hotel in Los Angeles. NY is Eastern Time, LA is Pacific Time —3 hours behind. If it's 2:00 PM in NY, what time is it in LA?

?? Key Time Zones (US)

Eastern (ET) → Central (CT): subtract 1 hour

Central (CT) → Mountain (MT): subtract 1 hour

Mountain (MT) → Pacific (PT): subtract 1 hour

Eastern to Pacific: subtract 3 hours

Worked Example: Converting Eastern to Pacific

It's 2:00 PM Eastern Time

Pacific is 3 hours behind Eastern

2:00 PM - 3 hours = 11:00 AM

Answer: 11:00 AM Pacific Time

Worked Example: Converting Pacific to Eastern

Flight departs LA at 8:00 AM Pacific

Eastern is 3 hours ahead of Pacific

8:00 AM + 3 hours = 11:00 AM

Answer: 11:00 AM Eastern Time when flight departs

Worked Example: International: London to New York

London (GMT) is 5 hours ahead of New York (ET)

Meeting in London at 3:00 PM GMT

New York time: 3:00 PM - 5 hours = 10:00 AM ET

Answer: 10:00 AM Eastern Time

  **Practice: Time Zone Conversions**

1. 3:00 PM Eastern. What time is it Pacific?

Work: _____

Answer: _____

2. 9:00 AM Pacific. What time is it Eastern?

Work: _____

Answer: _____

3. Noon Central. What time is it Mountain?

Work: _____

Answer: _____

4. 5:00 PM Mountain. What time is it Eastern?

Work: _____

Answer: _____

5. Call scheduled for 2:00 PM Pacific. What time in Central?

Work: _____

Answer: _____

6. Flight departs NY (ET) at 6:00 AM. What time is that in LA (PT)?

Work: _____

Answer: _____

7. Meeting in Chicago (CT) at 10:00 AM. Time in Denver (MT)?

Work: _____

Answer: _____

8. London is 5 hours ahead of NY. If NY is 8:00 PM, London time?

Work: _____

Answer: _____

9. Tokyo is 14 hours ahead of LA. LA is 3:00 PM. Tokyo time?

Work: _____

Answer: _____

10. Paris is 6 hours ahead of Eastern. Paris is 8:00 PM. Eastern time?

Work: _____

Answer: _____

11. Hawaii is 5 hours behind Eastern. NY is 4:00 PM. Hawaii time?

Work: _____

Answer: _____

12. Conference call: 9 AM Pacific. Times for CT, ET, and London (8 hrs ahead of PT)?

Work: _____

Answer: _____

Section 2: Flight Planning — Elapsed Time with Time Zones

The Scenario

A flight leaves New York at 8:00 AM Eastern and flies 5 hours to Los Angeles. What time does it arrive in LA local time? You must account for both the flight duration AND the time zone change!

Worked Example: Cross-Country Flight

Depart NY: 8:00 AM Eastern

Flight time: 5 hours

Step 1: Add flight time: 8:00 AM + 5 hours = 1:00 PM Eastern

Step 2: Convert to Pacific: 1:00 PM - 3 hours = 10:00 AM Pacific

Arrival: 10:00 AM Pacific Time

Worked Example: Eastbound Flight (Gaining Time)

Depart LA: 11:00 AM Pacific

Flight time: 5 hours

Step 1: Add flight time: 11:00 AM + 5 hours = 4:00 PM Pacific

Step 2: Convert to Eastern: 4:00 PM + 3 hours = 7:00 PM Eastern

Arrival: 7:00 PM Eastern Time

Worked Example: Overnight International Flight

Depart NY: 7:00 PM Eastern (Thursday)

Flight to London: 7 hours, London is 5 hours ahead

Step 1: 7:00 PM + 7 hours = 2:00 AM Eastern (Friday)

Step 2: Convert: 2:00 AM + 5 hours = 7:00 AM London time (Friday)

Arrival: 7:00 AM Friday, London time

  **Practice: Flight Time Calculations**

1. Depart Chicago (CT) 9:00 AM, fly 4 hours to Denver (MT). Arrival local time?

Work: _____

Answer: _____

2. Depart LA 6:00 AM PT, fly 5.5 hours to NY. Arrival ET?

Work: _____

Answer: _____

3. Depart NY 3:00 PM ET, fly 6 hours to London (5 hrs ahead). Arrival?

Work: _____

Answer: _____

4. Depart Denver 2:00 PM MT, fly 3 hours to Chicago. Arrival CT?

Work: _____

Answer: _____

5. Flight is 4 hours. Depart Seattle (PT) 8:00 AM, arrive Dallas (CT). Arrival?

Work: _____

Answer: _____

6. Depart Miami (ET) 11:00 PM, fly 5 hours to LA. Arrival PT? What day?

Work: _____

Answer: _____

7. Depart London 10:00 AM, fly 8 hours to NY (5 hrs behind). Arrival ET?

Work: _____

Answer: _____

8. Round trip: NY to LA (5 hrs) and back (5 hrs). Depart NY 6 AM ET. Return ET?

Work: _____

Answer: _____

9. Layover: Arrive Chicago 2:00 PM CT. Depart 5:30 PM CT. Layover time?

Work: _____

Answer: _____

10. Depart Tokyo 1:00 PM (14 hrs ahead of PT), fly 11 hours to LA. Arrival PT?

Work: _____

Answer: _____

11. Depart Phoenix (MT) 7:30 AM, fly 2 hr 45 min to Dallas (CT). Arrival?

Work: _____

Answer: _____

12. Depart NY noon ET, arrive Paris 7:00 AM next day (6 hrs ahead). Flight time?

Work: _____

Answer: _____

Section 3: Trip Budgeting — Large Number Calculations

?? The Scenario

A family of 4 wants a 7-day trip. Airfare is \$450 per person, hotel is \$189 per night, and activities budget is \$200 per day. Calculate the total trip cost and compare packages!

Worked Example: Calculating Total Trip Cost

Airfare: 4 people \times \$450 = \$1,800

Hotel: 7 nights \times \$189 = \$1,323

Activities: 7 days \times \$200 = \$1,400

Food: 7 days \times \$150 = \$1,050

Total: \$1,800 + \$1,323 + \$1,400 + \$1,050 = \$5,573

Trip cost: \$5,573

Worked Example: Comparing Packages

Package A: \$1,200/person all-inclusive \times 4 = \$4,800

Package B: Separate booking = \$5,573 (from above)

Savings: \$5,573 - \$4,800 = \$773

Better deal: Package A saves \$773

Worked Example: Per-Person Cost

Total trip: \$5,573 for 4 people

Per person: \$5,573 \div 4 = \$1,393.25

Cost per person: \$1,393.25

?? Practice: Travel Cost Calculations

1. Airfare \$385/person \times 6 people. Total airfare?

Work: _____

Answer: _____

2. Hotel \$225/night \times 5 nights. Total hotel cost?

Work: _____

Answer: _____

3. Family of 5, all-inclusive \$950/person. Total cost?

Work: _____

Answer: _____

4. Trip costs: Air \$2,400, Hotel \$1,575, Food \$840, Activities \$650. Total?

Work: _____

Answer: _____

5. Total trip \$6,240 for 4 people. Cost per person?

Work: _____

Answer: _____

6. Package A: \$4,500 total. Package B items total \$5,125. Savings with A?

Work: _____

Answer: _____

7. Budget \$8,000. Costs total \$7,450. Under budget by how much?

Work: _____

Answer: _____

8. Rental car: \$89/day \times 10 days + \$45 insurance. Total?

Work: _____

Answer: _____

9. Cruise: \$1,299/person \times 4 + \$400 port fees + \$600 excursions. Total?

Work: _____

Answer: _____

10. Hotel upgrade: \$189/night vs \$249/night for 7 nights. Difference?

Work: _____

Answer: _____

11. 6 people split \$5,400 trip equally. Each pays?

Work: _____

Answer: _____

12. Flight \$525, hotel \$1,400, food \$500, activities \$375, transport \$200. Grand total?

Work: _____

Answer: _____

Chapter 7 Action Report: Family Vacation Planning

Plan a complete cross-country vacation!

Flight Schedule

1. Flight departs Boston (ET) 7:30 AM, arrives San Francisco (PT) after 6 hours. Arrival local?

Work: _____

Answer: _____

2. Return flight departs SF 4:00 PM PT, 5.5 hour flight. Arrival in Boston ET?

Work: _____

Answer: _____

3. Total travel time (both flights)?

Work: _____

Answer: _____

Time Zone Coordination

4. Family in Boston wants to video call family at hotel in SF at 8 PM Pacific. Boston time?

Work: _____

Answer: _____

5. Dinner reservation in SF at 7:00 PM. Reminder set for Boston time?

Work: _____

Answer: _____

6. Flight confirmation says departure 7:30 AM ET. Convert to Pacific and Central.

Work: _____

Answer: _____

Budget

7. Airfare: \$475/person \times 4. Hotel: \$199/night \times 6 nights. Total air + hotel?

Work: _____

Answer: _____

8. Food budget \$175/day \times 7 days. Activities \$125/day \times 5 days. Total?

Work: _____

Answer: _____

9. Car rental \$79/day \times 7 days + \$55 insurance. Total transport?

Work: _____

Answer: _____

10. Grand total for entire trip? Per person cost?

Work: _____

Answer: _____

CHAPTER 8

The Small Business Owner

Chapter Goal: Master profit/loss calculations and financial projections to run a successful business.

Congratulations—you're opening your own business! Every decision affects your profit: pricing, costs, expenses, growth. Understanding the numbers is the difference between success and failure.

Section 1: The Bottom Line — Revenue, Cost, Profit

❖❖ The Scenario

You sell handmade candles. Each candle costs \$4 to make and sells for \$12. You sold 150 candles this month. What's your profit?

❖❖ Key Formulas

Revenue = Price × Quantity Sold

Cost = Cost per item × Quantity

Profit = Revenue - Total Costs

✍ Worked Example: Calculating Profit

Selling price: \$12/candle. Cost: \$4/candle. Sold: 150

Revenue: $\$12 \times 150 = \$1,800$

Cost of goods: $\$4 \times 150 = \600

Profit: $\$1,800 - \$600 = \$1,200$

Profit: \$1,200

✍ Worked Example: Including Fixed Costs

Same candle business, but add: Rent \$200, Utilities \$50, Supplies

\$75 Fixed costs: $\$200 + \$50 + \$75 = \325

Net profit: $\$1,200 - \$325 = \$875$

Net profit: \$875 after all expenses

✍ Worked Example: Profit Margin Percentage

Revenue: \$1,800. Net profit: \$875

Profit margin = $(\text{Profit} \div \text{Revenue}) \times 100$

$= (\$875 \div \$1,800) \times 100 = 48.6\%$

Profit margin: 48.6%

  **Practice: Revenue, Cost, and Profit**

1. Sell 200 items at \$15 each. Revenue?

Work: _____

Answer: _____

2. Items cost \$6 each to make. Cost for 200 items?

Work: _____

Answer: _____

3. Revenue \$3,000. Costs \$1,200. Profit?

Work: _____

Answer: _____

4. Sold 85 shirts at \$25. Cost per shirt \$10. Profit?

Work: _____

Answer: _____

5. Revenue \$5,400. Fixed costs \$800. Variable costs \$2,700. Net profit?

Work: _____

Answer: _____

6. Price \$18, cost \$7, sold 250 units. Profit?

Work: _____

Answer: _____

7. Revenue \$4,500, profit \$1,800. What were total costs?

Work: _____

Answer: _____

8. Need \$2,000 profit. Price \$20, cost \$12. How many must sell?

Work: _____

Answer: _____

9. Revenue \$12,000. Profit margin 35%. Profit amount?

Work: _____

Answer: _____

10. Profit \$1,500. Revenue \$6,000. Profit margin %?

Work: _____

Answer: _____

11. Sold 500 units, profit \$2,500. Profit per unit?

Work: _____

Answer: _____

12. Monthly expenses: Rent \$450, utilities \$125, supplies \$225, insurance \$100. Total fixed?

Work: _____

Answer: _____

Section 2: Setting Prices — Markup and Discounts

?? The Scenario

You buy wholesale items for \$20 each. You want a 75% markup. What's your selling price? Later, you offer a 20% sale. What's the sale price?

Worked Example: Calculating Markup

Cost: \$20. Markup: 75%

Markup amount: $\$20 \times 0.75 = \15

Selling price: $\$20 + \$15 = \$35$

Price: \$35 (or: $\$20 \times 1.75 = \35)

Worked Example: Calculating Discount

Regular price: \$35. Discount: 20%

Discount amount: $\$35 \times 0.20 = \7

Sale price: $\$35 - \$7 = \$28$

Sale price: \$28 (or: $\$35 \times 0.80 = \28)

Worked Example: Profit After Discount

Cost: \$20. Sale price: \$28

Profit per item: $\$28 - \$20 = \$8$

Original profit was: $\$35 - \$20 = \$15$

Profit decrease: $\$15 - \$8 = \$7$ (or 47% less profit)

Note: 20% off price = 47% less profit!

  **Practice: Markup and Discounts**

1. Cost \$40. Markup 50%. Selling price?

Work: _____

Answer: _____

2. Cost \$25. Markup 100% (double). Selling price?

Work: _____

Answer: _____

3. Price \$80. Discount 25%. Sale price?

Work: _____

Answer: _____

4. Cost \$15, selling \$36. Markup percentage?

Work: _____

Answer: _____

5. Regular \$50, sale \$35. Discount percentage?

Work: _____

Answer: _____

6. Cost \$30, markup 60%. Then 15% discount. Final price?

Work: _____

Answer: _____

7. Buy wholesale \$12, sell \$30. Markup % ?

Work: _____

Answer: _____

8. Price \$45, 30% off sale. Cost was \$20. Profit per item at sale price?

Work: _____

Answer: _____

9. Cost \$8, want 125% markup. Selling price?

Work: _____

Answer: _____

10. Original \$120, now \$84. Discount %?

Work: _____

Answer: _____

11. After 40% markup, price is \$56. Original cost?

Work: _____

Answer: _____

12. Cost \$25, sell \$50, offer 20% discount. Still profitable? By how much?

Work: _____

Answer: _____

Section 3: Looking Ahead — Financial Projections

❖❖ The Scenario

Your business sold \$3,000 in January, \$3,600 in February, \$4,320 in March. You're growing 20% each month! Project future sales and plan for growth.

❖ Worked Example: Projecting with Percentage Growth March

sales: \$4,320. Growth rate: 20%

April projection: $\$4,320 \times 1.20 = \$5,184$

May projection: $\$5,184 \times 1.20 = \$6,220.80$

Projections: April \$5,184, May \$6,221

❖ Worked Example: Break-Even Analysis

Fixed costs: \$500/month. Price: \$25. Cost per item: \$10.

Profit per item: $\$25 - \$10 = \$15$

Break-even: $\$500 \div \$15 = 33.3$ items

Must sell at least 34 items to cover costs

Break-even point: 34 items

❖ Worked Example: Annual Revenue from Monthly

Average monthly revenue: \$4,500

Annual projection: $\$4,500 \times 12 = \$54,000$

Annual revenue: \$54,000

❖❖ Practice: Financial Projections

1. Sales \$2,000. Grow 10% monthly. Next month projection?

Work: _____

Answer: _____

2. January \$5,000, growing 15%/month. April projection? (3 months later)

Work: _____

Answer: _____

3. Fixed costs \$750. Profit per item \$12. Break-even quantity?

Work: _____

Answer: _____

4. Average monthly sales \$8,500. Annual projection?

Work: _____

Answer: _____

5. This month: 200 customers. Growing 25%/month. Customers in 2 months?

Work: _____

Answer: _____

6. Fixed costs \$1,200. Price \$40, cost \$22. Break-even?

Work: _____

Answer: _____

7. Q1 total \$18,000. If same rate, annual projection?

Work: _____

Answer: _____

8. Sales: Jan \$1,000, Feb \$1,500, Mar \$2,250. Growth %? April projection?

Work: _____

Answer: _____

9. Need \$36,000 annual revenue. Required monthly average?

Work: _____

Answer: _____

10. Profit margin 40%. Need \$800/month profit. Monthly revenue needed?

Work: _____

Answer: _____

11. Fixed costs \$600, profit per unit \$8. Sold 100 units. Net profit?

Work: _____

Answer: _____

12. Current: \$4,000/month. Goal: \$10,000/month. Grow 25%/month. Months to goal?

Work: _____

Answer: _____

Chapter 8 Action Report: Monthly Business Review Complete this month-end business analysis!

Revenue Analysis

1. Sold 340 items at \$18 each. Monthly revenue?

Work: _____

Answer: _____

2. Items cost \$7 each to make. Total cost of goods?

Work: _____

Answer: _____

3. Gross profit (revenue - cost of goods)?

Work: _____

Answer: _____

Expense Tracking

4. Fixed costs: Rent \$650, Utilities \$180, Insurance \$120, Marketing \$250. Total?

Work: _____

Answer: _____

5. Net profit (gross profit - fixed costs)?

Work: _____

Answer: _____

6. Profit margin percentage?

Work: _____

Answer: _____

Pricing Check

7. Your markup % on \$7 cost items sold at \$18?

Work: _____

Answer: _____

8. Planning 25% off sale. Sale price?

Work: _____

Answer: _____

9. Profit per item at sale price?

Work: _____

Answer: _____

Projections

10. If sales grow 15% next month, projected revenue?

Work: _____

Answer: _____

11. Break-even: How many items needed to cover \$1,200 fixed costs at \$11 profit/item?

Work: _____

Answer: _____

12. Annual revenue projection based on this month?

Work: _____

Answer: _____

CHAPTER 9

The Science Lab Technician

Chapter Goal: Master order of operations and formulas to perform precise scientific calculations.

Welcome to the laboratory! As a Science Lab Technician, precision is everything. One calculation error can ruin an experiment. You'll use formulas, follow the order of operations exactly, and express very large and small numbers correctly.

Section 1: Following the Rules — Order of Operations

?? The Scenario

A formula reads: $3 + 4 \times 5 - 2$. Is the answer 33, 19, or 21? Without rules, everyone gets different answers. PEMDAS saves the day!

?? PEMDAS Rules

P - Parentheses first

E - Exponents next

MD - Multiplication and Division (left to right)

AS - Addition and Subtraction (left to right)

✍ Worked Example: Basic Order of Operations

Calculate: $3 + 4 \times 5 - 2$

Step 1: Multiplication first: $4 \times 5 = 20$

Step 2: Left to right: $3 + 20 - 2 = 21$

Answer: 21

✍ Worked Example: With Parentheses

Calculate: $(3 + 4) \times 5 - 2$

Step 1: Parentheses: $(3 + 4) = 7$

Step 2: Multiply: $7 \times 5 = 35$

Step 3: Subtract: $35 - 2 = 33$

Answer: 33

✍ Worked Example: With Exponents

Calculate: $2 + 3^2 \times 4$

Step 1: Exponent: $3^2 = 9$

Step 2: Multiply: $9 \times 4 = 36$

Step 3: Add: $2 + 36 = 38$

Answer: 38

✍ Worked Example: Complex Expression

Calculate: $48 \div (4 + 4) \times 2 - 3$

Step 1: Parentheses: $(4 + 4) = 8$

Step 2: Division (left to right): $48 \div 8 = 6$

Step 3: Multiply: $6 \times 2 = 12$

Step 4: Subtract: $12 - 3 = 9$

Answer: 9

❖❖ Practice: Order of Operations

1. Calculate: $8 + 3 \times 4$

Work: _____

Answer: _____

2. Calculate: $20 - 4 \times 3 + 2$

Work: _____

Answer: _____

3. Calculate: $(6 + 2) \times 5$

Work: _____

Answer: _____

4. Calculate: $36 \div 6 + 3 \times 2$

Work: _____

Answer: _____

5. Calculate: $5 + 2^3$

Work: _____

Answer: _____

6. Calculate: $(10 - 4)^2 \div 3$

Work: _____

Answer: _____

7. Calculate: $100 - 5 \times 10 + 25$

Work: _____

Answer: _____

8. Calculate: $18 \div (2 + 4) \times 5$

Work: _____

Answer: _____

9. Calculate: $4^2 + 3^2 - 5$

Work: _____

Answer: _____

10. Calculate: $2 \times (8 + 4) \div 3$

Work: _____

Answer: _____

11. Calculate: $50 - 2 \times 3^2 + 1$

Work: _____

Answer: _____

12. Calculate: $(15 - 5) \times (8 \div 2)$

Work: _____

Answer: _____

13. Calculate: $24 \div 4 + 6 \times 3 - 5$

Work: _____

Answer: _____

14. Calculate: $3 \times (4 + 2)^2 \div 9$

Work: _____

Answer: _____

15. Calculate: $100 \div (5 + 5) \div 2 + 8$

Work: _____

Answer: _____

16. Calculate: $2^3 + 4^2 - 3 \times 5$

Work: _____

Answer: _____

Section 2: Lab Formulas — Substituting Values

The Scenario

The formula for density is $D = M \div V$ (mass divided by volume). If a sample has mass 45 grams and volume 15 cubic centimeters, what's its density?

Worked Example: Using the Density Formula

Formula: $D = M \div V$

Given: $M = 45 \text{ g}$, $V = 15 \text{ cm}^3$

Substitute: $D = 45 \div 15 = 3$

Density: 3 g/cm^3

Worked Example: Temperature Conversion

Formula: $F = (9/5 \times C) + 32$

Convert 25°C to Fahrenheit

$F = (9/5 \times 25) + 32$

$F = (1.8 \times 25) + 32 = 45 + 32 = 77$

Answer: 77°F

Worked Example: Speed Formula

Formula: Speed = Distance \div Time

A car traveled 240 miles in 4 hours

$\text{Speed} = 240 \div 4 = 60 \text{ mph}$

Speed: 60 miles per hour

 **Worked Example: Finding a Missing Value**

Speed = 50 mph, Time = 3 hours. Find Distance.

Rearrange: Distance = Speed \times Time

Distance = $50 \times 3 = 150$ miles

Distance: 150 miles

 **Practice: Using Formulas**

1. $D = M \div V$. $M = 80$ g, $V = 20$ cm³. Find D.

Work: _____

Answer: _____

2. $F = 1.8C + 32$. Convert 30°C to Fahrenheit.

Work: _____

Answer: _____

3. Speed = Distance \div Time. 180 miles in 3 hours. Speed?

Work: _____

Answer: _____

4. Distance = Speed \times Time. 65 mph for 4 hours. Distance?

Work: _____

Answer: _____

5. Area = Length \times Width. L = 12, W = 8. Area?

Work: _____

Answer: _____

6. Perimeter = 2L + 2W. L = 15, W = 9. Perimeter?

Work: _____

Answer: _____

7. Volume = L \times W \times H. 5 \times 4 \times 3. Volume?

Work: _____

Answer: _____

8. Average = Sum \div Count. Sum = 450, Count = 6. Average?

Work: _____

Answer: _____

9. $C = (F - 32) \div 1.8$. Convert 86°F to Celsius.

Work: _____

Answer: _____

10. Time = Distance \div Speed. 300 miles at 60 mph. Time?

Work: _____

Answer: _____

11. Simple Interest = Principal \times Rate \times Time. $\$1,000 \times 0.05 \times 2$ years.

Work: _____

Answer: _____

12. Force = Mass \times Acceleration. $M = 50$ kg, $A = 3$ m/s 2 . Force?

Work: _____

Answer: _____

Section 3: Powers and Patterns — Exponents

?? The Scenario

Bacteria double every hour. Starting with 1 bacterium: after 1 hour = 2, after 2 hours = 4, after 3 hours = 8. That's 2^1 , 2^2 , 2^3 ... Exponents show repeated multiplication!

Worked Example: Understanding Exponents

2^4 means $2 \times 2 \times 2 \times 2 = 16$

Base: 2, Exponent: 4

Read as: '2 to the fourth power'

$2^4 = 16$

Worked Example: Powers of 10

$10^1 = 10$

$10^2 = 100$

$10^3 = 1,000$

$10^4 = 10,000$

Pattern: The exponent tells how many zeros!

$10^6 = 1,000,000$ (one million)

 **Worked Example: Bacteria Growth Problem**

Start with 5 bacteria, double every hour

After n hours: 5×2^n

After 6 hours: $5 \times 2^6 = 5 \times 64 = 320$ bacteria

Answer: 320 bacteria

 **Practice: Exponents**

1. Calculate: 3^4

Work: _____

Answer: _____

2. Calculate: 5^3

Work: _____

Answer: _____

3. Calculate: 2^6

Work: _____

Answer: _____

4. Calculate: 10^5

Work: _____

Answer: _____

5. Write 81 as a power of 3.

Work: _____

Answer: _____

6. Write 64 as a power of 2.

Work: _____

Answer: _____

7. Bacteria double hourly. Start 10. After 5 hours? (10×2^5)

Work: _____

Answer: _____

8. Calculate: 4^3

Work: _____

Answer: _____

9. Calculate: $2^5 + 3^2$

Work: _____

Answer: _____

10. Population triples yearly. Start 100. After 4 years? (100 \times 3⁴)

Work: _____

Answer: _____

11. Write 1,000,000 as a power of 10.

Work: _____

Answer: _____

12. Calculate: $6^2 \times 2^3$

Work: _____

Answer: _____

Chapter 9 Action Report: Lab Calculations

Complete these lab analysis problems!

Order of Operations

1. Calculate: $5 + 3 \times 8 - 12 \div 4$

Work: _____

Answer: _____

2. Calculate: $(24 - 4) \div (2 + 3)$

Work: _____

Answer: _____

3. Calculate: $2^3 \times 4 - 6^2$

Work: _____

Answer: _____

Formula Applications

4. Density: M = 156 g, V = 12 cm³. Find D.

Work: _____

Answer: _____

5. Convert 35°C to Fahrenheit. ($F = 1.8C + 32$)

Work: _____

Answer: _____

6. Speed = 72 mph, Time = 4.5 hours. Distance?

Work: _____

Answer: _____

Exponents

7. Calculate: 4^4

Work: _____

Answer: _____

8. Bacteria start at 8, double every hour. Count after 8 hours?

Work: _____

Answer: _____

9. Write 10,000,000 as a power of 10.

Work: _____

Answer: _____

Combined Problems

10. Solution A: $D = 2.5 \text{ g/cm}^3$. Solution B: $D = 3.2 \text{ g/cm}^3$. Which is denser? By how much?

Work: _____

Answer: _____

11. Experiment runs 2^4 minutes. How many minutes? How many hours?

Work: _____

Answer: _____

12. Formula: $\text{Result} = (A + B)^2 \div C$. $A = 3$, $B = 5$, $C = 4$. Result?

Work: _____

Answer: _____

CHAPTER 10

The Startup Founder

Chapter Goal: Apply ALL your fifth-grade math skills to launch and run your own business!

This is it—your capstone project! You're launching a tech startup that creates and sells mobile apps. You'll use every skill from this year: decimals, fractions, percentages, coordinates, statistics, time zones, profit calculations, and formulas. Let's build a business!

Part 1: Startup Costs and Funding

You need \$25,000 to launch. Calculate your funding sources and expenses.

1. Personal savings: \$8,500. Family loan: \$6,750. Crowdfunding: \$5,425. Bank loan: remainder. Bank loan amount?

Work: _____

Answer: _____

2. Equipment: \$7,850.45. Software licenses: \$2,345.99. Legal fees: \$1,875.50. Office setup: \$3,428.06. Total startup expenses?

Work: _____

Answer: _____

3. Money remaining after expenses from \$25,000?

Work: _____

Answer: _____

4. If 35% of startup costs are equipment-related, what's that amount?

Work: _____

Answer: _____

Part 2: Product Development Timeline

Plan your development schedule across time zones.

5. Developer in India (10.5 hours ahead of Eastern). Your meeting at 8 AM ET = what time in India?

Work: _____

Answer: _____

6. Development takes 720 hours total. Working 8 hrs/day, 5 days/week, how many weeks?

Work: _____

Answer: _____

7. Start March 1, need 18 weeks. Completion date?

Work: _____

Answer: _____

8. Team meeting: LA (PT), Chicago (CT), NY (ET), London (5 hrs ahead ET). Meeting at 10 AM ET. Times for each?

Work: _____

Answer: _____

Part 3: App Store Pricing

Set prices and calculate revenue.

9. App costs \$0.85 to distribute. You price at \$2.99. Profit per sale?

Work: _____

Answer: _____

10. App store takes 30% of price. Your net per sale after store fee?

Work: _____

Answer: _____

11. After store fee AND distribution cost, actual profit per sale?

Work: _____

Answer: _____

12. First month: 4,250 downloads. Revenue at \$2.99 each?

Work: _____

Answer: _____

Part 4: User Statistics

Analyze your user data.

13. Daily users (Week 1): 150, 225, 340, 510, 425, 380, 290. Mean?

Work: _____

Answer: _____

14. Same data: Median?

Work: _____

Answer: _____

15. Same data: Range?

Work: _____

Answer: _____

16. Users growing 40%/month. Month 1: 1,000 users. Month 4 projection?

Work: _____

Answer: _____

Part 5: Office Space

Design your startup office.

17. L-shaped office: main 30×20 ft, extension 15×10 ft. Total area?

Work: _____

Answer: _____

18. Rent is \$2.25 per square foot. Monthly rent?

Work: _____

Answer: _____

19. Meeting room takes up 1/8 of total space. Meeting room area?

Work: _____

Answer: _____

20. Desk area: 6×4 ft each. How many desks fit in remaining 5/8 of space?

Work: _____

Answer: _____

Part 6: Growth Projections

Project your business growth.

21. Month 1 revenue: \$12,707.50. Growing 25%/month. Month 3 revenue?

Work: _____

Answer: _____

22. Fixed costs: \$4,500/month. Profit per download: \$1.24. Break-even downloads?

Work: _____

Answer: _____

23. Year 1 projection if monthly average is \$18,000?

Work: _____

Answer: _____

24. Investor wants 15% of profits. Year 1 projected profit \$85,000. Investor share?

Work: _____

Answer: _____

Part 7: Final Business Report

Synthesize everything into a business summary.

25. Total Year 1 revenue projection: \$216,000. Total costs: \$148,500. Net profit?

Work: _____

Answer: _____

26. Net profit as percentage of revenue (profit margin)?

Work: _____

Answer: _____

27. If you reinvest 40% of profit back into the business, reinvestment amount?

Work: _____

Answer: _____

28. Remaining profit split between 2 founders. Each receives?

Work: _____

Answer: _____

29. Year 2 goal: grow revenue 50%. Year 2 revenue target?

Work: _____

Answer: _____

30. At same profit margin, Year 2 projected profit?

Work: _____

Answer: _____

About Global Sovereign University

"Building a Bridge to Freedom Through Education—Not Handouts"

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Together, we build capability—not dependency.

Extra Practice

Additional problems for each chapter

Chapter 1: Decimals Extra Practice

?? Mixed Review

1. Round \$456.7891 to nearest cent.

Work: _____

Answer: _____

2. Order: 3.405, 3.45, 3.045, 3.504 (least to greatest)

Work: _____

Answer: _____

3. Add: $234.567 + 89.45 + 12.8$

Work: _____

Answer: _____

4. Subtract: $1,000 - 456.789$

Work: _____

Answer: _____

5. Multiply: 45.6×7.8

Work: _____

Answer: _____

6. Calculate 18% tip on \$85.50

Work: _____

Answer: _____

7. Bill \$124.50, tax 8.5%. Total with tax?

Work: _____

Answer: _____

8. Add: \$1,234.56 + \$567.89 + \$234.50

Work: _____

Answer: _____

9. Convert 6.5% to decimal.

Work: _____

Answer: _____

10. Revenue \$2,456.78, expenses \$1,234.56. Net?

Work: _____

Answer: _____

11. Multiply: 125×0.065 (6.5% tax)

Work: _____

Answer: _____

12. 25% of \$840 = ?

Work: _____

Answer: _____

Chapter 2: Volume Extra Practice

?? Mixed Review

1. Volume: $8 \times 6 \times 5$ ft

Work: _____

Answer: _____

2. Container: $40 \times 8 \times 9$ ft. Volume?

Work: _____

Answer: _____

3. Box: $24 \times 18 \times 12$ in. Dim weight ($\div 139$)?

Work: _____

Answer: _____

4. Truck: $1,200 \text{ ft}^3$. Boxes 15 ft^3 each. How many fit?

Work: _____

Answer: _____

5. Convert: 6,912 cubic inches to cubic feet.

Work: _____

Answer: _____

6. Warehouse bay: $25 \times 20 \times 12$ ft. Capacity?

Work: _____

Answer: _____

7. Package: weighs 25 lbs, dim weight 32 lbs. Shipping at \$0.55/lb?

Work: _____

Answer: _____

8. Pallet: $4 \times 4 \times 6$ ft. Volume?

Work: _____

Answer: _____

9. Truck floor: 24×8 ft. Box base: 3×2 ft. Boxes per layer?

Work: _____

Answer: _____

10. Space: 800 ft^3 . Large boxes: 40 ft^3 (need 12). Small: 5 ft^3 . How many small fit?

Work: _____

Answer: _____

11. Two trucks: 960 ft^3 and $1,440 \text{ ft}^3$. Total capacity?

Work: _____

Answer: _____

12. 50 boxes at 16 ft^3 **each.** Total volume needed?

Work: _____

Answer: _____

