Name:                                    Date:

# Math 25 Final Exam

*Work for up to 110 minutes.*

*Calculators **are** allowed. Your Math 25 notes and the Math 25 Packet **are** allowed. Looking at the Math25.net website online is **not** allowed.*

*Reduce fraction answers. No need to change improper fraction answers to mixed numerals.*

**Show numbered step-by-step answers!**

## Review Problems (Do 5 of 13)

**1.** How many factors does 56 have?

**2.** Find the prime factorization of 3456.

**3.** Solve $5 \times ( 6 + 20 \times 6 ) + 12 - 8 + 81 \div 3^2 \times 2^3$

**4.** Find $\frac{45}{60} \div \frac{9}{10}$

**5.** Find the sum of $\frac{2}{2}$, $\frac{3}{4}$, and $\frac{5}{5}$ using common denominators.

**6.** A number minus $\frac{1}{60}$ equals $\frac{1}{5}$. What is the number?

**7.** Brand A costs $16.51 for 14 ounces. Brand B costs $18.40 for 18 ounces. What is the price per ounce for each? Which is the better buy?

**8.** Solve: $\frac{35}{6} = \frac{n}{30}$

**9.** 566.84 is what percent of 383?

**10.** Two mad scientists are chatting. One brags that his info-buster has a length of 70 kilometers. The other mentally changes this amount into miles. How many miles is it? (There are about 1.61 kilometers in a meter.)

**11.** Coffee-lover Chuck drinks 17 cups of coffee each day. How many gallons per year is this?

**12.** Stalwart the Wonder Snail crawls 8,000 yards in 6 minutes. Express this speed in miles per hour.

**13.** A crate has a mass of 169.383 grams. How many milligrams is this? Do not round your answer.

**1.** One serving of spaghetti with meat sauce has 12 grams of fat, 32 grams of carbohydrates (including 7 grams from sugar), and 19 grams of protein. Change to calories these amounts of fat, carbohydrate, sugar, and protein.

**2.** Continuing the previous probem, what percentage of the food's calories come from protein?

**3.** Frank is a 69-year-old moderately active man who weighs 137 pounds and is 5 feet 2 inches tall. What is his estimated BMR?

**4.** Continuing the previous probem, what is his estimated DCI?

**5.** Your friend is a 71-year-old very active woman who weighs 110 pounds and is 5 feet 4 inches tall. What is her estimated BMR?

**6.** Continuing the previous probem, what is her estimated DCI?

**7.** Continuing the previous probem, that same friend runs for 3 hours and 24 minutes. Running burns 0.09 calories per pound per minute. How many calories does your friend burn? To how many 50-calorie *York Peppermint Pattie* mini-size candies is this equivalent?

**8.** Continuing the previous probem, what is that friend's maximum safe heart rate, minimum aerobic exercise heart rate, and maximum aerobic exercise heart rate?

**9.** A recipe that makes 16 servings requires 5 pounds of Red Blossom Leeks. Red Blossom Leeks have a yield percent of 75%. How many pounds of Red Blossom Leeks should you purchase if you are scaling up the recipe to make 169 servings?

**10.** Continuing the previous probem, if Red Blossom Leeks cost $0.77 per pound, what will that ingedient cost?

**11.** One gallon of olive oil weighs 7.6 pounds. What is the weight of 19.5 cups of olive oil?

**12.** Express 4.0625 cups as 4 cups and some tablespoons.

**13.** Express 11 teaspoons as 3 tablespoons and some teaspoons.

**14.** Find the mean of these six numbers: 42, 22, 81, 10, 122, 17.

**15.** Continuing the previous probem, find the median of those six numbers.

**16.** A small business borrows $4,616 at a 28% annual simple interest rate. It repays the loan after 128 days. How much interest does it owe?

**17.** Joyce pays for a $616 payday loan for 28 days with a post-dated check for $629.23. What was the loan's simple interest rate?

**18.** Scrooge McDuck has an investment that appreciates 18% the first year. The next year the investment depreciates, and is worth what he started with. What is the second year's percent change?

**19.** Sir Topham Hatt invests $10,000 by letting that amount grow for 26 years in an account that earns 2% annual interest, compounded monthly. At the start of the next year, he moves all the money into a different account for 28 years at 5% annual interest, compounded quarterly. How much is in the account at the end of all 54 years?

**20.** Clementine can afford monthly mortgage payments of $648. Clementine wants a 30-year loan. The interest rate is 8%. How large a loan is affordable?

**21.** How much will Clementine pay total over the 30 years?

**22.** How much of what Clementine pays over the 30 years is interest?

**23.** Cindy saved for retirement for 18 years, by depositing $2,480 each year into an accout with 9% annual interest. Then she stopped making more deposits. The account continued to grow at 9% annual interest for an additional 32 years before she and her husband retired. How much was in the account at the end of the first 18 years? How much was in the account at the end of all 50 years?

| Amortization Table (monthly payment per $1,000 of loan) | | | | | |
|---|---|---|---|---|---|
| | **Years** | | | | |
| Rate | 10 | 15 | 20 | 25 | 30 |
| 5% | $10.60 | $7.91 | $6.60 | $5.85 | $5.36 |
| 6% | $11.10 | $8.44 | $7.16 | $6.44 | $6.00 |
| 7% | $11.60 | $8.99 | $7.75 | $7.07 | $6.65 |
| 8% | $12.10 | $9.56 | $8.36 | $7.72 | $7.34 |

**24.** Leslie starts a new credit card that charges 27% annual interest per year to keep her bookkeeping simple when buying a $5,669 computer. (She will use the card for nothing else.) The credit card charges her one-twelfth of its annual interest rate each month. Leslie pays $1040 per month until the balance is paid off. Finish the table below. Then find her total interest in dollars.

| Month | Starting | Payment | Interest Due On | Interest | Ending |
|---|---|---|---|---|---|
| 1 | $5669.00 | $1040.00 | $4629.00 | $104.15 | $4733.15 |
| 2 | ? | $1040.00 | ? | ? | $3776.25 |
| 3 | $3776.25 | $1040.00 | $2736.25 | $61.57 | $2797.82 |
| 4 | $2797.82 | $1040.00 | $1757.82 | $39.55 | $1797.37 |
| 5 | ? | $1040.00 | ? | ? | $774.41 |
| 6 | $774.41 | $774.41 | $0.00 | $0.00 | $0.00 |
| | | | | **TOTAL = ???** | |

**25.** A store uses a markup on wholesale cost of 23%. They buy an item from their supplier for $48. What retail selling price should they use when trying to sell this item?

**26.** A store uses a markup on retail selling price of 57%. They know an item can sell if it is priced at $335. What wholesale cost must they find if they want to stock this item?

**27.** An item that normally sells for $53 is on sale for 28% off. Then that sale price is reduced by another 13%. What is the new sale price?

**28.** A restaurant meal that serves 7 people has $33 food cost, $38 labor cost, and $23 other cost. What price per plate should the meal be assigned according to the *desired profit method* with a 18% desired profit?

**29.** A restaurant meal that serves 7 people has $33 food cost, $38 labor cost, and $23 other cost. What price per plate should the meal be assigned according to the *food cost percentage method* with a 38% scale factor?

**30.** What is the probability of rolling a sum of 10 or more on two dice? Write you answer as a fraction with denominator 36, and as a percentage.

**31.** What are the odds of rolling a sum of 10 or more on two dice?

**32.** A student is about to take a final exam. Her grades so far in the class are listed below. What percent score is needed on the final to earn an overall grade of 80% in the class?

|  | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
|  | 3 | 4 | 5 | 6 | 7 | 8 |
|  | 4 | 5 | 6 | 7 | 8 | 9 |
|  | 5 | 6 | 7 | 8 | 9 | 10 |
|  | 6 | 7 | 8 | 9 | 10 | 11 |
|  | 7 | 8 | 9 | 10 | 11 | 12 |

| Item | Score | % of Grade |
|------|-------|-----------|
| Attendance | 89% | 20% |
| Homework | 72% | 25% |
| Midterm #1 | 69% | 18% |
| Midterm #2 | 62% | 21% |
| Final | **??** % | 16% |

**33.** The final exam in the previous problem has 68 questions, each worth one point. How many problems does she need to get correct?

## Review Problems

**1.** There are **8** factors: 1, 56, 2, 28, 4, 14, 7, 8

**2.** The prime factorization is **2 × 2 × 2 × 2 × 2 × 2 × 2 × 3 × 3 × 3**.

**3.** The amount in the parenthesis simplifies to 126. So the first term is 5 × 126 = 630.

The second and third terms are plain numbers: add 12 and subtract 8.

The fourth term involves two exponents. The first part becomes 81 ÷ 9 = 9. The second exponent equals 8. Then 9 × 8 = 72

Thus the entire list of terms is 630 + 12 − 8 + 72 = **706**.

**4.** First flip the second fraction change division to multiplication: $\frac{45}{60} \times \frac{10}{9}$.

Then cancel the top right and bottom left: $\frac{\mathbf{5}}{60} \times \frac{10}{\mathbf{1}}$.

Then cancel the bottom right and top left: $\frac{5}{\mathbf{6}} \times \frac{\mathbf{1}}{1}$.

Then multiply the fractions to find the final answer of $\frac{\mathbf{5}}{\mathbf{6}}$.

**5.** The common denominator is 20. We add $\frac{20}{20} + \frac{15}{20} + \frac{20}{20} = \frac{55}{20}$. The reduced fraction is $\frac{\mathbf{11}}{\mathbf{4}}$.

**6.** First notice that 60 will work as a common denominator. So change the second fraction to get $\frac{1}{60} + \frac{12}{60}$. Then add numerators to get $\frac{13}{60}$.

**7.** Brand A costs $1.18 per ounce. Brand B costs $1.02 per ounce. **Brand B** is the better buy.

**8.** $n = 35 \times 30 \div 6 \approx$ **175.0**

**9.** Translate the percent sentence as $566.84 = y \times 383$. Solve for $y$ by dividing both sides by 383. The answer is **148%**.

**10.** About 43.5 miles.

**11.** There are 16 cups in a gallon, and 365 days in a year. So 17 cups per day is equal to about 388 gallons per year.

**12.** When we use Unit Analysis we find out we need to multiply by 3 (to change from yards to feet), divide by 5,280 (to change from feet to miles), and multiply by 60 (to change from minutes to hours).

$$\frac{?\ \text{yards}}{??\ \text{minutes}} \cdot \frac{3\ \text{feet}}{1\ \text{yard}} \cdot \frac{1\ \text{mile}}{5{,}280\ \text{feet}} \cdot \frac{60\ \text{minutes}}{1\ \text{hour}}$$

So Stalwart crawls at about 45.45 miles per hour.

**13.** The *K-H-D-U-D-C-M-x-x-micro* shortcut from converting grams into milligrams is to scoot the decimal point 3 places to the right. So the answer is 169,383 milligrams.

## Math 25 Problems

**1.** The spaghetti with meat sauce has $12 \times 9 =$ **108 calories** from fat.
It has $32 \times 4 =$ **128 calories** from carbohydrates.
Sugar is a kind of carbohydrate, so it also has $7 \times 4 =$ **28 calories** from sugar.
It has $19 \times 4 =$ **76 calories** from protein.

**2.** We find the total calories by adding up the calories from fat, carbohydrates, and protein. This total is 312. Then we divide the 76 calories from protein by the 312 total calories (and use RIP LOP) to get an answer of about **24%**.

**3.** A man's BMR = (weight × 4.55) + (height × 15.88) − (age × 5) − 161 = (137 × 4.55) + (62 × 15.88) − (69 × 5) − 161 ≈ **1,102 calories per day**.

**4.** The DCI for a moderately active man is BMR × 1.78 ≈ **1,962 calories per day**.

**5.** A woman's BMR = (weight × 4.55) + (height × 15.88) − (age × 5) + 5 = (110 × 4.55) + (64 × 15.88) − (71 × 5) + 5 ≈ **1,167 calories per day**.

**6.** The DCI for a very active woman is BMR × 1.82 ≈ **2,124 calories per day**.

**7.** 0.09 × 110 pounds × 204 minutes ≈ **2,020 calories**, equivalent to about 40 *York Peppermint Pattie* mini-size candies.

**8.** Our friend's maximum safe heart rate = 220 − age = 220 − 71 = **149 beats per minute**. The upper limit for aerobic exercise = maximum safe heart rate × 0.85 ≈ **127 beats per minute**. The lower limit for aerobic exercise = maximum safe heart rate × 0.5 ≈ **75 beats per minute**

**9.** We scale up the recipe by 169 desired servings ÷ 16 recipe servings ≈ 10.56.

So 5 pounds × 10.56 scale factor ÷ 0.75 yield percent ≈ **70.4 pounds of Red Blossom Leeks**.

**10.** 70.4 pounds × $0.77 per pound ≈ **$54.21**.

**11.** Replace 1 gallon with 16 cups. Then use a proportion.
If 16 cups weigh 7.6 pounds, how much will 19.5 cups weigh?
19.5 × 7.6 ÷ 16 ≈ **9.3 pounds**.

**12.** There are 16 tablespoons in a cup. So we multiply the 0.0625 by 16.
0.0625 × 16 ≈ 1 tablespoons.
So our final answer is **4 cups and 1 tablespoons**.

**13.** First we divide to switch to tablespoons.
11 tsp ÷ 3 tsp per Tbsp = 3.67 Tbsp.
Then we multiply the decimal amount by 3 to go backwards and change it back to teaspoons.
0.67 × 3 = 2 teaspoons.
So our final answer is **3 tablespoons and 2 teaspoons**.

**14.** The sum of the six numbers is 294. The mean is 294 ÷ 6 = **49**.

**15.** The sorted numbers are: 10, 17, 22, 42, 81, 122, so the median is the average of 22 and 42, which is **32**.

**16.** Use the simple interest formula.

$I = P \times r \times t = \$4{,}616 \times 0.28 \times (128 \div 365) = $ **$453.25**.

**17.** Use the simple interest formula.

$I = P \times r \times t = \$13.23 = \$616 \times r \times (28 \div 365)$

We can isolate the rate by dividing by $616 and then dividing by (28 ÷ 365).

Then we use RIP LOP to turn the decimal value into percent format.

Our final answer is $r = 28\%$.

**18.** The decrease is a percent change.

$change \div original = (0.18 \times principal) \div (1.18 \times principal) = 0.18 \div 1.18 \approx$ **15.25%**.

**19.** We use the compound interest formula twice. Each time the new total = $P \times (1 + r)^t$.

For the first account, $\$10{,}000 \times (1 + 0.0016666666666666668)^{312} =$ $16,813.00.

For the second account, $\$16{,}813.00 \times (1 + 0.0125)^{112} = $ **$67,590.98**.

**20.** The Amortization Table value for 30 years and 8% is $7.34 per thousand dollars of loan. We divide $648 ÷ $7.34 ≈ 88 thousands of loan, so a **$88,000** loan.

**21.** Over the 30 years Clementine will pay $648 × 12 × 30 = **$233,280**.

**22.** The amount of interest is thus $233,280 − $88,000 = **$145,280**.

**23.** We use the sum of annuity due formula to find out that Cindy has saved **$111,645.78** at the end of the first 18 years. Then we use the compound interest

formula to find that 32 years later the final amount is **$1,759,909.14**.

**24.** The second row is

| 2 | $4733.15 | $1040.00 | $3693.15 | $83.10 | $3776.25 |
|---|----------|----------|----------|--------|----------|

The fifth row is

| 5 | $1797.37 | $1040.00 | $757.37 | $17.04 | $774.41 |
|---|----------|----------|---------|--------|---------|

The total interest is **$305.41**.

**25.** The store should use a retail selling price of $48 × (1 + 0.23) = **$59.04** for that item.

**26.** The store should find a wholesale cost of $335 × (1 − 0.57) = **$144.05** to stock that item.

**27.** After the first discount 72% of the original price remains. After the second discount 87% of that reduced price remains. So the final sale price is $53 × 0.72 × 0.87 = **$33.20**.

**28.** The *desired profit method* has a cost per plate of
(food cost + labor cost + other costs) × scale factor ÷ servings = ($33 + $38 + $23) × 1.18 ÷ 7 = **$15.85**.

**29.** The *food cost percentage method* has a cost per plate of
food cost ÷ scale factor ÷ servings = $33 ÷ 0.38 ÷ 7 = **$12.41**.

**30.** There are 6 ways to roll 10 or more on two dice. So we write can probability as the fraction $^6/_{36}$, or as the rounded percentage **17%**.

**31.** There are 6 ways to roll 10 or more on two dice, so there are 36 − 6 = 30 ways this might not happen. The odds are **6 to 30**. We can reduce the odds and say **1 to 5**.

**32.** Multiply across each row, using RIP LOP on only one of the percentages in each row, to find the expected values.

| Item | Score | % of Grade | Expected Value |
|------|-------|------------|----------------|
| Attendance | 89% | 20% | 17.8 |
| Homework | 72% | 25% | 18 |
| Midterm #1 | 69% | 18% | 12.42 |
| Midterm #2 | 62% | 21% | 13.02 |
| Final | **??** % | 16% | |
| | | | Total: 61.24 |

Since she wants an overall grade of 80% in the class, the final exam needs an expected value of 80 − 61.24 = 18.76, which requires a final exam score of **117%**

**33.** Unfortunately, a final exam score of **117%** is impossible.