



# Math OER

## Math 105 Midterm #1

*Calculators **are** allowed.  
Your own Math 105 notes **are** allowed.  
The official [formula page](#) **is** allowed.*

*Looking at the class textbook, class website, or other websites is **not** allowed.*

*Start by taking this test by yourself. Working with people is (sadly) **not** yet allowed.*

*Get everything you need organized into your own useful notes!*

***This will be an in-class test. Turn in your test by submitting photos of your work.***

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

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

*Your best **22 problems** will count for your grade. Consider doing more than 22 problems to have some "safety net problems" in case your main 22 problems have errors.*

### *Problem Solving*

1. The value of a stock for three days is \$93, \$103, and \$63. What was its percent increase on the second day? What was its percent decrease on the third day?
2. Scrooge McDuck has an investment that appreciates 12% the first year. The next year the investment depreciates, and is worth what he started with. What is the second year's percent change?
3. A college is expanding from 646 to 2,193 students. It has 38 instructors. How many more instructors must it hire to maintain its student-to-faculty ratio?
4. A store uses 18% margin rate. They know an item can sell if it is priced at \$353. What wholesale cost must they find if they want to stock this item?

5. A store uses a 25% markup rate. They buy an item from their supplier for \$38. What selling price should they use when trying to sell this item?
6. A store attracts customers with a loss leader that sells for \$3.83. Each sale costs the store \$0.57. Each month the store sells 353 of that item. How much does this loss leader cost the store?
7. A fancy new phone has a skim price of \$438 initially, but the sale price eventually settles at the penetration price of \$250. The wholesale cost is \$138. Divide the larger margin by the smaller margin to find the percentage of extra margin from skimming.
8. An item that normally sells for \$44 is on sale for 18% off. Then that sale price is reduced by another 21%. What is the new sale price?
9. A store puts an item on sale using a chain of three discounts. The first two discounts are 15% and 12%. If the desired single equivalent discount rate is 42%, what should the size of the third discount rate?

## Finance

10. Archibald can afford monthly mortgage payments of \$738. Archibald wants a 15-year loan. The interest rate is 8%. How large a home is affordable?

11. Eventually Archibald finds a home worth that much, with a 24% downpayment. What is the downpayment amount?

12. The loan has a 1% fee. What is the fee amount?

13. How much in monthly payments will Archibald pay total over the 15 years?

14. How much of what Archibald pays in monthly payments over the 15 years is interest?

15. Leslie starts a new credit card that charges 18% annual interest per year to keep her bookkeeping simple when buying a \$5,282 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 \$970 per month until the balance is paid off. Finish the table below. Then find her total interest in dollars.

	Years				
	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

Month	Starting	Payment	Interest Due On	Interest	Ending
1	\$5282.00	\$970.00	\$4312.00	\$64.68	\$4376.68
2	?	\$970.00	?	?	\$3457.78
3	\$3457.78	\$970.00	\$2487.78	\$37.32	\$2525.10
4	\$2525.10	\$970.00	\$1555.10	\$23.33	\$1578.43
5	?	\$970.00	?	?	\$617.56
6	\$617.56	\$617.56	\$0.00	\$0.00	\$0.00
				<b>TOTAL = ???</b>	

**16.** A small business borrows \$1,676 at a 27% annual simple interest rate. It repays the loan after 118 days. How much interest does it owe?

*Look at the next four word problems. Wait to actually solve the problems. Prepare by writing which formula you will use to solve the problem and explain how you know that formula is indeed the proper one for the situation.*

**17.** For problem 21 the formula to use is \_\_\_\_\_ and the clues that show that are \_\_\_\_\_.

**18.** For problem 22 the formula to use is \_\_\_\_\_ and the clues that show that are \_\_\_\_\_.

**19.** For problem 23 the formula to use is \_\_\_\_\_ and the clues that show that are \_\_\_\_\_.

**20.** For problem 24 the formula to use is \_\_\_\_\_ and the clues that show that are \_\_\_\_\_.

**21.** Sterling can afford a \$218 per month car payment, and will get a 7 year loan at 14% interest. How expensive of a car is affordable?

**22.** Tannis invests \$11,000 by letting that amount grow for 28 years in an account that earns 3.5% annual interest, compounded weekly. How much is in the account at the end?

**23.** Antonio saved for retirement for 40 years, by depositing \$396 at the start of each year into an account with 4% annual interest. How much was in the account at the end?

**24.** Maria pays for a \$676 payday loan for 18 days with a post-dated check for \$686. What was the loan's simple interest rate?

*Be careful with these two-step problems.*

**25.** Sir Topham Hatt invests \$11,000 by letting that amount grow for 28 years in an account that earns 3% annual interest, compounded monthly. At the start of the next year, he moves all the money into a different account for 18 years at 2% annual interest, compounded quarterly. How much is in the account at the end of all 46 years?

**26.** Celia saved for retirement for 19 years, by depositing \$880 each year into an account with 6% annual interest. Then she stopped making more deposits. The account continued to grow at 6% annual interest for an additional 31 years before she and her husband retired. How much was in the account at the end of the first 19 years? How much was in the account at the end of all 50 years?

## Problem Solving

1. The change for the first day was \$10, so the percent change is that amount divided by \$93, which becomes 10.8%. The change for the second day was -\$40, so the percent change is that amount divided by \$103, which becomes -38.8%.

2. The decrease is a percent change.

$change \div original = (0.12 \times principal) \div (1.12 \times principal) = 0.12 \div 1.12 \approx 10.71\%$ .

3. The old faculty-to-student ratio is  $646 \div 38 = 17$ . The number of students is increasing by 1547. So the college must hire  $1547 \div 17 = 91$  **more instructors**.

4. The store should find a wholesale cost of  $\$353 \times (1 - 0.18) =$  **\$289.46** to stock that item.

5. The store should use a selling price of  $\$38 \times (1 + 0.25) =$  **\$47.50** for that item.

6. The total loss is  $\$0.57 \times 353 =$  **\$201.21**.

7. The skim margin is  $\$438 - \$138 = \$300$ . The penetration margin is  $\$250 - \$138 = \$112$ . When we divide,  $\$300 \div \$112 \approx 2.7$  **times as much margin** when skimming.

8. After the first discount 82% of the original price remains. After the second discount 79% of that reduced price remains. So the final sale price is  $\$44 \times 0.82 \times 0.79 =$  **\$28.50**.

9. The first two discounts are 15% and 12%, which mean that they leave 85% and 88% remaining. The single equivalent discount rate of 42% would leave 58% remaining. So we need to solve the equation  $0.85 \times 0.88 \times y = 0.58$ . The answer is  $y = 0.77$  for what remains after the third discount, corresponding to a discount rate of **23%**.

## Finance

10. The Amortization Table value for 15 years and 8% is \$9.56 per thousand dollars of loan. We divide  $\$738 \div \$9.56 \approx 77$  thousands of loan, so a **\$77,000** home.

11. The downpayment amount is  $\$77,000 \times 0.24 =$  **\$18,480**.  
(So the actual loan size is  $\$77,000 - \$18,480 = \$58,520$ )  
(So the actual monthly payment is  $58.52 \times \$9.56 = \$559.45$ )

12. The fee amount is  $\$58,520 \times 0.01 =$  **\$585.2**.

**13.** Over the 15 years Archibald will pay  $\$559.45 \times 12 \times 15 \approx$   
**\$100,701.**

**14.** The amount of interest is thus  $\$100,701 - \$77,000 =$  **\$23,701.**

**15.** The second row is

2	\$4376.68	\$970.00	\$3406.68	\$51.10	\$3457.78
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The fifth row is

5	\$1578.43	\$970.00	\$608.43	\$9.13	\$617.56
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The total interest is **\$185.56.**

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

$$I = P \times r \times t = \$1,676 \times 0.27 \times (118 \div 365) = \mathbf{\$146.29}.$$

**21.** Use the decreasing annuity formula to find a loan size of

$$\$218 \times (1 - 1.0117^{-84}) \div 0.0117 = \mathbf{\$11,632.86}.$$

**22.** We use the compound interest formula.  $\text{Total Amount} = P \times (1 + r)^t$

$$\$11,000 \times (1 + 0.0007)^{1456} = \mathbf{\$29,299.36}.$$

**23.** We use the annual increasing annuity formula to find a savings of  
**\$39,135.31.**

**24.** Use the simple interest formula.

$$I = P \times r \times t = \$10 = \$676 \times r \times (18 \div 365)$$

We can isolate the rate by dividing by \$676 and then dividing by (18 ÷ 365).

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

Our final answer is  $r =$  **30%.**

**25.** We use the compound interest formula twice. Each time  $\text{Total Amount} = P \times (1 + r)^t$

$$\text{For the first account, } \$11,000 \times (1 + 0.0025)^{336} = \$25,453.34.$$

$$\text{For the second account, } \$25,453.34 \times (1 + 0.0050)^{72} = \mathbf{\$36,450.31}.$$

**26.** We use the annual increasing annuity formula to find out that Cindy has saved **\$31,491.32** at the end of the first 19 years. Then we use the compound interest formula to find that 31 years later the final amount is **\$191,722.33.**