

Math 112 - Test 3
November 19, 2018

Name key Score _____

Show all work to receive full credit. Supply explanations where necessary.

1. (5 points) Jillian deposited \$700 into an investment account earning 6.75% simple interest. At the end of the investment period, she had \$841.75. How long was the investment period?

$$I = 841.75 - 700 = 141.75$$

$$141.75 = (700)(0.0675)t \Rightarrow t = 3 \text{ years}$$

2. (5 points) Martin needs \$1829 to purchase furniture. The furniture store lends Martin the money at 11% simple interest for two years.

- (a) How much interest will Martin pay?

$$I = (1829)(0.11)(2) = 402.38$$

$$\$402.38$$

- (b) Martin decides to pay the total amount (principal + interest) in 24 equal monthly payments. How much is each payment?

$$\begin{array}{r} 1829 \\ + 402.38 \\ \hline 2231.38 \end{array}$$

$$2231.38 \div 24 = 92.97$$

$$\$92.97$$

3. (5 points) What simple interest rate would be required to double the value of a \$12,000 investment in 10 years?

To double 12,000, you need 12,000 in interest...

$$12000 = (12000)(r)(10)$$

$$\Rightarrow r = 0.1 = 10\%$$

4. (6 points) Compute and compare the effective interest rates in order to determine the better investment: 3.05% compounded monthly or 3.075% compounded semiannually.

3.05% MONTHLY

$$E = \left(1 + \frac{0.0305}{12}\right)^{12} - 1$$

$$\approx 0.03093$$

$$= \underline{\underline{3.0937\%}}$$

3.075% Semi

$$E = \left(1 + \frac{0.03075}{2}\right)^2 - 1$$

$$\approx 0.03099$$

$$= \underline{\underline{3.099\%}}$$

3.075%
SEMIANNUALLY
IS A BIT
BETTER.

5. (8 points) A 25-year-old plans to retire at age 60. She decides to invest an inheritance of \$80,000 at 7% interest compounded semiannually.

(a) How much money will be in the account when she is 60 years old?

$$P = 80000$$

$$r = 0.07$$

$$n = 2$$

$$t = 35$$

$$A = 80000 * \left(1 + \frac{0.07}{2}\right)^{(2*35)} = 889026.02$$

$$\boxed{\$ 889,026.02}$$

(b) How much money is made in interest?

$$889026.02 - 80000$$

$$= \boxed{\$ 809,026.02}$$

6. (6 points) You found an investment account that earns 5.75% compounded monthly. How much should you deposit now (at one time) so that your investment grows to \$56,000 in 10 years?

$$A = 56000$$

$$t = 10$$

$$r = 0.0575$$

$$n = 12$$

$$P = ?$$

$$56000 = P * \left(1 + \frac{0.0575}{12}\right)^{(12*10)}$$

↓

$$P = \frac{56000}{\left(1 + \frac{0.0575}{12}\right)^{(12*10)}}$$

$$= \boxed{\$ 31,554.77}$$

7. (6 points) A company needs to have \$4,000,000 in 10 years. The company will make quarterly payments into an account earning 8.75% compounded quarterly. How much will the quarterly payments be on the annuity?

$$A = 4000000$$

$$t = 10$$

$$r = 0.0875$$

$$n = 4$$

$$R = ?$$

$$R = \frac{4000000 * (0.0875/4)}{\left(\left(1 + 0.0875/4 \right)^{(4*10)} - 1 \right)} = \$63,573.80$$

8. (8 points) Suppose you open an annuity with monthly payments of \$250 at 5% compounded monthly for 18 years.

- (a) Find the future value of the annuity.

$$R = 250$$

$$r = 0.05$$

$$n = 12$$

$$t = 18$$

$$A = ?$$

$$A = \frac{250 * \left(\left(1 + 0.05/12 \right)^{(12*18)} - 1 \right)}{\left(0.05/12 \right)} = \$87,300.51$$

- (b) How much interest will you earn?

$$87300.51 - (250)(12)(18) = \$33,300.51$$

9. (6 points) Jamal has learned that he can get a new car by agreeing to make monthly payments of \$368 for five years. After reading the fine print, he realized that these monthly payments include a finance charge of 9.99% compounded monthly. How much would the car cost Jamal if he paid all at once in cash?

$$R = 368$$

$$t = 5$$

$$r = 0.0999$$

$$n = 12$$

$$P = ?$$

$$P = \frac{368 * \left(1 - \left(1 + 0.0999/12 \right)^{(-12*5)} \right)}{\left(0.0999/12 \right)} = \$17,324.07$$

10. (18 points) A house sells for \$186,450 and a 9% down payment is made. For the remaining balance, a 20-year mortgage is secured at 3.25% compounded monthly.

(a) How much is the down payment?

$$186450 \times 0.09 = \boxed{\$16,780.50}$$

(b) What is the loan amount?

$$186450 - 16780.50 = \boxed{\$169,669.50}$$

(c) What is the monthly payment?

$$P = 169669.50$$

$$r = 0.0325$$

$$t = 20$$

$$n = 12$$

$$R = \frac{169669.50 * (0.0325/12)}{(1 - (1 + 0.0325/12)^{-12*20})} = \boxed{\$962.36}$$

(d) When the loan is paid off in 20 years, what will be the total interest paid?

$$962.36 \times 12 \times 20 - 169669.50 = \boxed{\$61,296.90}$$

(e) Compute the first 3 rows of the amortization schedule. Include the payment number, interest, amount paid to principal, and the outstanding balance.

Payment #	Payment Amount	Interest	Payment to Principal	Balance	
1	962.36	459.52	502.84	169,166.66	$(169669.50)(0.0325)(\frac{1}{12}) = 459.52$
2	962.36	458.16	504.20	168,662.46	$(169166.66)(0.0325)(\frac{1}{12}) = 458.16$
3	962.36	456.79	505.57	168,156.89	$(168662.46)(0.0325)(\frac{1}{12}) = 456.79$
			4		

11. (8 points) Compute each of the following.

$$(a) 7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = \boxed{5040}$$

$$(b) \frac{6!}{4!} = \frac{6 \times 5 \times \cancel{4!}}{\cancel{4!}} = \boxed{30}$$

$$(c) \frac{200!}{2!199!} = \frac{\overset{160}{\cancel{200}} \times \cancel{199!}}{2 \times 1 \times \cancel{199!}} = \boxed{100}$$

$$(d) {}_6P_4 = \frac{6!}{(6-4)!} = \frac{6!}{2!} = 6 \times 5 \times 4 \times 3 = \boxed{360}$$

12. (3 points) A pizzeria offers single-topping pizzas with four choices of crust, three choices of sauce, and eight choices of toppings. How many different pizzas can be made?

$$4 \times 3 \times 8 = \boxed{96}$$

13. (9 points) The upper case letters A, B, C, D, E, F are used to form a 4-letter code.

(a) How many codes are possible if letters can be reused?

$$6 \times 6 \times 6 \times 6 = \boxed{1296}$$

(b) How many codes are possible if letters cannot be reused?

$$6 \times 5 \times 4 \times 3 = \boxed{360}$$

(c) How many codes are possible if the letters can be reused, but the code cannot begin with A and cannot end with F?

$$5 \times 6 \times 6 \times 5 = \boxed{900}$$

14. (4 points) How many different arrangements can be made from all the letters of the word *MISSISSIPPI*?

$$\frac{11!}{4!4!2!} = \frac{11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5}{4 \times 3 \times 2 \times 1 \times 2 \times 1} = 11 \times 10 \times 9 \times 7 \times 5 = \boxed{34,650}$$

15. (3 points) Digits are selected without replacement from the set {2,4,6}. How many different 3-digit numbers can be formed? After you have determined how many, list them all.

$$3 \times 2 \times 1 = \boxed{6}$$

246, 264, 426, 462, 624, 642

6

↑ All six of them.