6-7 Compound Interest MATH 161 THOMPSON

COMPOUND INTEREST:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = Pe^{rt}$$

A ← final amount; P ← principle (initial amount); r ← interest rate; t ← time

Use for continuously

1) Find the amount that results from the given investment

$600 invested at 7% compounded quarterly after a period of 3 years

After 3 years, the investment results in $____

Quarterly → n = 4 *Have to put all parenthesis* $600(1+(\frac{0.07}{4}))^{(4\cdot3)} \approx \$738.86$

**exponent also has to be in parenthesis after the ^ key*

2) Find the amount that results from the given investment

$300 invested at 12% compounded quarterly after a period of 4 ½ years

After 4 ½ years, the investment results in $____

Quarterly → n = 4 *Have to put all parenthesis* $300(1+(\frac{0.12}{4}))^{(4\cdot4.5)} \approx \$510.73$

**exponent also has to be in parenthesis after the ^ key*

3) Find the amount that results from the given investment

$400 invested at 3% compounded daily after a period of 2 years

After 2 years, the investment results in $____

Daily → n = 365 *Have to put all parenthesis* $400(1+(\frac{0.03}{365}))^{(365\cdot2)} \approx \$424.73$

**exponent also has to be in parenthesis after the ^ key*

4) Find the amount that results from the given investment

$10 invested at 11% compounded continuously after a period of 2 years

After 2 years, the investment results in $____

continuously Pe^{rt} $10e^{(.11\cdot2)} \approx \$12.46$

5) Find the principal needed now to get the given amount, that is, find the present value

To get $90 after 3¼ years at 9% compounded continuously.

$90 = Pe^{(0.09\cdot3.25)}$ → $90e^{(-0.09\cdot3.25)}$ *** to get use negative exponent**

negative exponent means dividing* **P ≈ $67.18

6) Find the principal needed now to get the given amount, that is, find the present value

To get $200 after 4 years at 9% compounded quarterly.

$200 = P\left(1+\frac{0.09}{4}\right)^{(4\cdot 4)}$ $\quad 200\left(1+\frac{0.09}{4}\right)^{(-4\cdot 4)}$ * to get use negative exponent

*negative exponent means dividing

P ≈ $140.09

7) Find the principal needed now to get the given amount, that is, find the present value

To get $60 after 2½ years at 4% compounded continuously.

$60 = Pe^{(0.04\cdot 2.5)} \rightarrow \quad 60e^{(-0.04\cdot 2.5)}$ * to get use negative exponent

*negative exponent means dividing

P ≈ $54.29

8) If Tanisha has $100 to invest at 8% per annum (a)compounded quarterly, how long will it be before she has $200? *quarterly → n = 4*

$200 = 100\left(1+\frac{0.08}{4}\right)^{(4t)}$ *divide by 100* $2 = (1.02)^{4t}$ *then take ln of both sides*

$\rightarrow \frac{\ln 2}{4\ln 1.02} = \frac{(4t)\ln 1.02}{4\ln 1.02}$

divide right side to get t:

$\left(\frac{\ln(2)}{(4\ln 1.02)}\right) \rightarrow t \approx 8.75$

(b) compounded continuously, how long will it be?

$200 = 100(e)^{(.08t)}$ *divide by 100* $2 = e^{0.08t}$ *then take ln of both sides →*

$\frac{\ln(2)}{.08} = \frac{.08t}{.08}$ lne = 1 so its cancelled

t ≈ 8.66

9) How many years will it take for an initial investment of $40,000 to grow to $60,000? Assume rate of interest of 20% compounded continuously.

$60,000 = 40,000(e)^{(.0.2\cdot t)}$

$1.5 = (e)^{(0.2t)}$ $\quad 1.5 = e^{0.2t}$ *then take ln of both sides →*

$\frac{\ln(1.5)}{0.2} = \frac{0.2t}{0.2}$ lne = 1 so its cancelled

t ≈ 2.03

10) What will a $210,000 house cost 5 years from now if the price appreciation for homes over the period averages 3% compounded annually?

$A = 210000\left(1+\left(\frac{0.03}{1}\right)\right)^{(5)}$ A ≈ $243,447.56

11) Jerome will be buying a used car for $11,000 in 4 years. How much money should he ask his parents for now so that, if he invests it at 8% compounded continuously, he will have enough to buy the car?

$11{,}000 = P(e)^{(.08\cdot 4)}$ **negative exponent means dividing*

$11{,}000(e)^{(-.08\cdot 4)}$ P≈ $7987.64

12) Survey estimates the current average cost for college to be $30,490 per year.

a) If the average cost increases by 8.5%, what will the cost by 10 years from now?

$A = 30490\left(1 + \left(\frac{0.085}{1}\right)\right)^{(10)}$ A ≈ $68937.39

b) If a savings plan offers 7.6% compounded continuously, how much should be put in a plan now to pay one year of college 10 years from now?

$68937.39 = Pe^{(0.076\cdot 10)}$ $68937.39e^{(-0.076\cdot 10)}$ P ≈ $32239.70

**negative exponent means dividing*

13) What rate of interest compounded annually is required to double an investment in 5 years?

$2 = (1 + r)^{(5)} \rightarrow \sqrt[5]{2} = 1 + r \rightarrow \sqrt[5]{2} - 1$ r = 14.87%