Compound Interest

For problems 1-2, an investment of $5000 is deposited into an account in which interest is compounded monthly. Complete the table by filling in the amounts to which the investment grows at the indicated times or interest rates.

1. $r = 4\%$

Time (years)	Amount
1	
2	
3	
4	
5	
6	

2. $t = 5$ years

Rate per year	Amount
1%	
2%	
3%	
4%	
5%	
6%	

3. If $10,000 is invested at an interest rate of 3% per year, compounded semiannually, find the value of the investment after the given number of years.
   (a) 5 years
   (b) 15 years
   (c) How long would it take to double your investment?

4. If $500 is invested at an interest rate of 3.75% per year, compounded quarterly, find the value of the investment after the given number of years.
   (a) 1 year
   (b) 10 years
   (c) How long would it take to double your investment?

For problems 5-6, the present value of a sum of money is the amount that must be invested now, at a given rate of interest, to produce the desired sum at a later date.

5. Find the present value of $10,000 if interest is paid at a rate of 9%per year, compounded semiannually, for 3 years.

6. Find the present value of $100,000 if interest is paid at a rate of 8% per year, compounded monthly, for 5 years.

7. If $2000 is invested at an interest rate of 3.5% per year, compounded continuously, find the value of the investment after the given number of years.
   (a) 2 years
   (b) 4 years
   (c) How long would it take to quadruple your investment?

8. If $600 is invested at an interest rate of 2.5% per year, find the amount of the investment at the end of 10 years for the following compounding methods.
   (a) Annually
   (b) Semiannually
   (c) Quarterly
   (d) Continuously

9. Which of the given interest rates and compounding periods would provide the better investment?
   (a) $5\frac{1}{8}$ % per year, compounded semiannually
   (b) 5% per year, compounded continuously

10. If $8000 is invested in an account for which interest is compounded continuously, find the amount of the investment at the end of 12 years for the following interest rates.
    (a) 2%
    (b) 3%
    (c) 4.5%
    (d) 7%

11. Which of the given interest rates and compounding periods would provide the best investment?
    (a) $2\frac{1}{2}$ % per year, compounded semiannually
    (b) $2\frac{1}{4}$ % per year, compounded monthly
    (c) 2% per year, compounded continuously

12. The population of a certain species of bird is limited by the type of habitat required for nesting. The population behaves according to the logistic growth model
$$\frac{5600}{0.5+27e^{-0.044t}}$$
where t is measured in years.
    (a) Find the initial bird population.
    (b) What size does the population approach as time goes on?
    (c) When will the population of birds reach 10,000?

13. The relative growth rate of world population has been decreasing steadily in recent years. On the basis of this, some population models predict that world population will eventually stabilize at a level that the planet can support. One such logistic model is
$$\frac{73.2}{6.1+5.9e^{-0.02t}}$$
where $t = 0$ is the year 2000 and population is measured in billions.
    (a) What world population does this model predict for the year 2200? For 2300?
    (b) According to this model, what size does the world population seem to approach as time goes on?
    (c) When will the population on earth reach 10 billion? Round to the nearest year.

Answers

1.

Time (years)	Amount
1	$5203.71
2	$5415.71
3	$5636.36
4	$5865.99
5	$6104.98
6	$6353.71

2.

Rate per year	Amount
1%	$5256.25
2%	$5525.39
3%	$5808.08
4%	$6104.98
5%	$6416.79
6%	$6744.25

3. a. $11,605.41
   b. $15,630.80
   c. 23.278 years

4. a. $519.02
   b. $726.23
   c. 18.570 years

5. $7678.96

6. $67,121.04

7. a. $2145.02
   b. $2300.55
   c. 36.968 years

8. a. $768.05
   b. $769.22
   c. $769.82
   d. $770.42

9. Investment 1: After 1 year, a $100 investment grows $105.19

10. a. $10,169.99
    b. $11,466.64
    c. $13,728.05
    d. $18,530.94

11. Investment 1: After 1 year, a $100 investment grows $102.51

12. a. 200
    b. 11,200
    c. 138.847 years

13. a. 11.79 billion; 11.97 billion
    b. 12 billion
    c. 2079