

# Compound Interest

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

With **compound interest**, you earn interest on your interest — each period the balance gets a little bigger, and the *next* round of interest is figured on that bigger balance. The formula is  $A = P \left(1 + \frac{r}{n}\right)^{nt}$ , where  $P$  is the principal,  $r$  is the yearly rate as a decimal,  $n$  is how many times per year it compounds, and  $t$  is the number of years. When interest compounds *once a year*,  $n = 1$  and this simplifies to  $A = P(1+r)^t$ . To find just the interest earned, subtract:  $I = A - P$ . Compounding always beats simple interest over time because the money keeps building on itself.

◇ **Example:** Find the value of a \$1,000 deposit at 5% compounded annually for 3 years.  
 ⇒ Since it compounds once a year, use  $A = P(1+r)^t$  with  $P = 1000$ ,  $r = 0.05$ , and  $t = 3$ . That gives  $A = 1000(1 + 0.05)^3 = 1000(1.05)^3$ . Now build up the power:  $1.05^2 = 1.1025$ , and  $1.1025 \times 1.05 = 1.157625$ . Multiply by the principal:  $1000 \times 1.157625 = 1157.625$ . Rounded to the nearest cent, the account is worth \$1,157.63, which is \$157.63 of interest.

**Answer:**  $A \approx \$1,157.63$

## PRACTICE

Find the final amount  $A$  (round to the nearest cent). Use the compound interest formula.

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| 1. $P = \$1,000$ , $r = 4\%$ , annual, $t = 2$ _____  | 12. $P = \$2,000$ , $r = 6\%$ , annual, $t = 2$ _____                |
| 2. $P = \$2,000$ , $r = 5\%$ , annual, $t = 3$ _____  | 13. $P = \$1,000$ , $r = 4\%$ , annual, $t = 3$ _____                |
| 3. $P = \$500$ , $r = 6\%$ , annual, $t = 2$ _____    | 14. $P = \$5,000$ , $r = 2\%$ , annual, $t = 4$ _____                |
| 4. $P = \$1,500$ , $r = 4\%$ , annual, $t = 4$ _____  | 15. Interest only: $P = \$1,000$ , $r = 4\%$ , annual, $t = 2$ _____ |
| 5. $P = \$800$ , $r = 10\%$ , annual, $t = 2$ _____   | 16. Interest only: $P = \$800$ , $r = 10\%$ , annual, $t = 2$ _____  |
| 6. $P = \$1,200$ , $r = 5\%$ , annual, $t = 2$ _____  | 17. $P = \$1,000$ , $r = 6\%$ , semiannual, $t = 2$ _____            |
| 7. $P = \$3,000$ , $r = 3\%$ , annual, $t = 3$ _____  | 18. $P = \$2,000$ , $r = 4\%$ , quarterly, $t = 1$ _____             |
| 8. $P = \$2,500$ , $r = 4\%$ , annual, $t = 2$ _____  | 19. $P = \$1,000$ , $r = 12\%$ , semiannual, $t = 1$ _____           |
| 9. $P = \$1,000$ , $r = 8\%$ , annual, $t = 2$ _____  | 20. $P = \$1,500$ , $r = 8\%$ , semiannual, $t = 2$ _____            |
| 10. $P = \$4,000$ , $r = 5\%$ , annual, $t = 2$ _____ |  |
| 11. $P = \$600$ , $r = 5\%$ , annual, $t = 3$ _____   |  |

## ◆ Word Problems

21. Devon invests \$800 in an account that earns 8% compounded annually. What is the account worth after 3 years, to the nearest cent? \_\_\_\_\_
22. A savings bond starts at \$5,000 and earns 5% compounded annually. How much *interest* has it earned after 2 years? \_\_\_\_\_
23. Two cousins each deposit \$1,000 for 2 years at 8%. One account uses simple interest; the other compounds annually. How much more does the compound account earn? \_\_\_\_\_
24. Priya puts \$2,000 in an account paying 4% compounded quarterly. What is the balance after 1 year, to the nearest cent? \_\_\_\_\_



## Answer Keys

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|---------------------------|----------------------------|
| 1. $A = \$1,081.60$       | 13. $A \approx \$1,124.86$ |
| 2. $A = \$2,315.25$       | 14. $A \approx \$5,412.16$ |
| 3. $A = \$561.80$         | 15. $I = \$81.60$          |
| 4. $A \approx \$1,754.79$ | 16. $I = \$168.00$         |
| 5. $A = \$968.00$         | 17. $A \approx \$1,125.51$ |
| 6. $A = \$1,323.00$       | 18. $A \approx \$2,081.21$ |
| 7. $A \approx \$3,278.18$ | 19. $A = \$1,123.60$       |
| 8. $A = \$2,704.00$       | 20. $A \approx \$1,754.79$ |
| 9. $A = \$1,166.40$       | 21. $A \approx \$1,007.77$ |
| 10. $A = \$4,410.00$      | 22. $I = \$512.50$         |
| 11. $A \approx \$694.58$  | 23. $\$6.40$ more          |
| 12. $A = \$2,247.20$      | 24. $A \approx \$2,081.21$ |

### Step-by-Step Explanations

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| <p>1. <math>A = 1000(1.04)^2 = 1000 \times 1.0816 = 1081.60</math>.</p> <p>2. <math>A = 2000(1.05)^3 = 2000 \times 1.157625 = 2315.25</math>.</p> <p>3. <math>A = 500(1.06)^2 = 500 \times 1.1236 = 561.80</math>.</p> <p>4. <math>A = 1500(1.04)^4 = 1500 \times 1.16985856 \approx 1754.79</math>.</p> <p>5. <math>A = 800(1.10)^2 = 800 \times 1.21 = 968</math>.</p> <p>6. <math>A = 1200(1.05)^2 = 1200 \times 1.1025 = 1323</math>.</p> <p>7. <math>A = 3000(1.03)^3 = 3000 \times 1.092727 \approx 3278.18</math>.</p> <p>8. <math>A = 2500(1.04)^2 = 2500 \times 1.0816 = 2704</math>.</p> <p>9. <math>A = 1000(1.08)^2 = 1000 \times 1.1664 = 1166.40</math>.</p> <p>10. <math>A = 4000(1.05)^2 = 4000 \times 1.1025 = 4410</math>.</p> <p>11. <math>A = 600(1.05)^3 = 600 \times 1.157625 \approx 694.58</math>.</p> <p>12. <math>A = 2000(1.06)^2 = 2000 \times 1.1236 = 2247.20</math>.</p> <p>13. <math>A = 1000(1.04)^3 = 1000 \times 1.124864 \approx 1124.86</math>.</p> <p>14. <math>A = 5000(1.02)^4 = 5000 \times 1.08243216 \approx 5412.16</math>.</p> <p>15. First <math>A = 1000(1.04)^2 = 1081.60</math>, then <math>I = A - P = 81.60</math>.</p> | <p>16. <math>A = 800(1.10)^2 = 968</math>, so <math>I = 968 - 800 = 168</math>.</p> <p>17. Semiannual means <math>n = 2</math>: <math>A = 1000 \left(1 + \frac{0.06}{2}\right)^4 = 1000(1.03)^4 \approx 1125.51</math>.</p> <p>18. Quarterly means <math>n = 4</math>: <math>A = 2000 \left(1 + \frac{0.04}{4}\right)^4 = 2000(1.01)^4 \approx 2081.21</math>.</p> <p>19. <math>n = 2</math>, so <math>A = 1000(1.06)^2 = 1000 \times 1.1236 = 1123.60</math>.</p> <p>20. <math>n = 2</math>, <math>nt = 4</math>: <math>A = 1500(1.04)^4 = 1500 \times 1.16985856 \approx 1754.79</math>.</p> <p>21. Use <math>A = P(1+r)^t = 800(1.08)^3</math>. Since <math>1.08^3 = 1.259712</math>, the value is <math>800 \times 1.259712 \approx \\$1,007.77</math>.</p> <p>22. First find the amount: <math>A = 5000(1.05)^2 = 5000 \times 1.1025 = \\$5,512.50</math>. Then <math>I = A - P = 5512.50 - 5000 = \\$512.50</math>.</p> <p>23. Simple: <math>I = 1000 \times 0.08 \times 2 = \\$160</math>. Compound: <math>A = 1000(1.08)^2 = \\$1,166.40</math>, so <math>I = \\$166.40</math>. The difference is <math>166.40 - 160 = \\$6.40</math>.</p> <p>24. Quarterly means <math>n = 4</math>, so <math>A = 2000 \left(1 + \frac{0.04}{4}\right)^4 = 2000(1.01)^4</math>. Since <math>1.01^4 \approx 1.04060401</math>, the balance is about <math>\\$2,081.21</math>.</p> |
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