Compound Interest

Name: _____ Date: _____ Score: _____ / 24

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.

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

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? _____

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Answer Keys

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

Step-by-Step Explanations

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

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