

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. $A = 1000(1.04)^2 = 1000 \times 1.0816 = 1081.60$.</p> <p>2. $A = 2000(1.05)^3 = 2000 \times 1.157625 = 2315.25$.</p> <p>3. $A = 500(1.06)^2 = 500 \times 1.1236 = 561.80$.</p> <p>4. $A = 1500(1.04)^4 = 1500 \times 1.16985856 \approx 1754.79$.</p> <p>5. $A = 800(1.10)^2 = 800 \times 1.21 = 968$.</p> <p>6. $A = 1200(1.05)^2 = 1200 \times 1.1025 = 1323$.</p> <p>7. $A = 3000(1.03)^3 = 3000 \times 1.092727 \approx 3278.18$.</p> <p>8. $A = 2500(1.04)^2 = 2500 \times 1.0816 = 2704$.</p> <p>9. $A = 1000(1.08)^2 = 1000 \times 1.1664 = 1166.40$.</p> <p>10. $A = 4000(1.05)^2 = 4000 \times 1.1025 = 4410$.</p> <p>11. $A = 600(1.05)^3 = 600 \times 1.157625 \approx 694.58$.</p> <p>12. $A = 2000(1.06)^2 = 2000 \times 1.1236 = 2247.20$.</p> <p>13. $A = 1000(1.04)^3 = 1000 \times 1.124864 \approx 1124.86$.</p> <p>14. $A = 5000(1.02)^4 = 5000 \times 1.08243216 \approx 5412.16$.</p> <p>15. First $A = 1000(1.04)^2 = 1081.60$, then $I = A - P = 81.60$.</p> | <p>16. $A = 800(1.10)^2 = 968$, so $I = 968 - 800 = 168$.</p> <p>17. Semiannual means $n = 2$: $A = 1000 \left(1 + \frac{0.06}{2}\right)^4 = 1000(1.03)^4 \approx 1125.51$.</p> <p>18. Quarterly means $n = 4$: $A = 2000 \left(1 + \frac{0.04}{4}\right)^4 = 2000(1.01)^4 \approx 2081.21$.</p> <p>19. $n = 2$, so $A = 1000(1.06)^2 = 1000 \times 1.1236 = 1123.60$.</p> <p>20. $n = 2$, $nt = 4$: $A = 1500(1.04)^4 = 1500 \times 1.16985856 \approx 1754.79$.</p> <p>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$.</p> <p>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.</p> <p>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$.</p> <p>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$.</p> |
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