The problems have equal credit. **Show your work!**

\[(\text{ANSWER}) + (\text{NO WORK}) = (\text{ZERO CREDIT})\].

Work that doesn’t make any sense counts as ‘no work’.

1. The cost of ordering \(x\) many Jabba the Hutt beanie babies from Outrageous KnockOffs, Inc., is given by a linear function. If the cost of ordering 10 Jabbas is $100 and the cost of ordering 25 is $205, what is the cost of ordering 15?

   **Solution.** Call the function \(f(x) = mx + b\). The slope \(m = (205 - 100)/(25 - 10) = 105/15 = 7\) and (after algebra) \(b = 30\). Therefore \(f(15) = 105 + 30 = 135\) dollars.

2. Find the slope-intercept equation of the line that passes through \((3, 5)\) and \((5, 3)\).

   **Solution.** Slope is \(-1\), \(b = 8\); equation is \(y = -x + 8\).

3. Solve the quadratic equation by factoring or using the quadratic formula. For full credit, give your answers in exact form (using radicals, integers, or fractions—NOT decimals).

   \[6x^2 - 7x = 3\].

   **Solution.** Rewrite it as \(6x^2 - 7x - 3 = 0\), which factors to \((3x + 1)(2x - 3) = 0\). The roots are \(-1/3\) and \(3/2\).

4. Find the coordinates \((h, k)\) of the vertex of the parabola whose equation is \(y = 2x^2 - 6x + 3\). Is this vertex a maximum or a minimum for the function? **Justify your answers!**

   **Solution.** \(h = -b/2a = 6/4 = 3/2\); \(k = c - b^2/4a = 3 - (36/8) = -3/2\). It’s a minimum because \(a = 2 > 0\).

5. A 100-unit apartment complex is full when the monthly rent per apartment is $1000. Experience has shown that, for every $20 increase in the rent, 1 unit will become empty. (We assume that the rent can only change in $20 increments.) What rent should the landlord charge to maximize his revenue?

   **Solution.** If the rent increases by \(x\) $20 increments, the total revenue will be \((100 + 20x)(100 - x) = 100000 + 1000x - 20x^2\) dollars, which has a maximum when \(x = -b/2a = 1000/40 = 25\). The optimal rent is \(1000 + (20)(25) = 1500\) dollars.

6. Find the vertical and horizontal asymptotes of the function

   \[f(x) = \frac{3x - 7}{2x + 5}\].

   **Solution.** Vertical: \(x = -5/2\). Horizontal: \(y = 3/2\).
7. One thousand dollars is invested in an account that earns 6% interest, compounded quarterly. How much will this investment be worth after 7 years? Round your answer to the nearest penny.

Solution. \(1000(1 + .06/4)^{28} = 1000(1.015)^{28} = 1517.22\) dollars.

8. In 1962, Warren Buffett’s net worth was $1 million (\(10^6\)). Today (47 years later) it is $37 billion (\(37 \times 10^9\)). Suppose—to make things simple—that his net worth has been growing at a constant rate, compounded annually. What is that rate? Round your answer to the nearest tenth of a percent.

Solution. We seek \(r\) such that

\[10^6(1 + r)^{47} = 37 \times 10^9,
\]

or

\[(1 + r)^{47} = 37000.\]

Taking roots and subtracting, we get

\[r = (37000)^{1/47} - 1 \approx .250823,
\]

which rounds to 25.1 percent.

9. Still talking about Warren Buffett (see problem #8): Suppose we assume that his net worth has been growing at a constant rate under continuous compounding. What is that rate? Again, round your answer to the nearest tenth of a percent.

Solution. We seek \(r\) such that

\[e^{47r} = 37000,
\]

which implies

\[r = \ln(37000)/47 \approx .223802,
\]

which rounds to 22.4 percent.

10. One thousand dollars will be invested in an account that pays 8% interest, compounded continuously. How long will it take for the investment’s value to grow to $1500? Round your answer to the nearest tenth of a year.

Solution. We seek \(t\) such that

\[1000e^{.08t} = 1500,
\]

which requires

\[t = \ln(1.5)/.08 \approx 5.06831,
\]

which rounds to 5.1 years.