

1. 10 pts. Find the exact distance between points $(-\frac{1}{2}, 3)$ and $(7, -5)$.

2. 15 pts. Complete the square and write the equation

$$x^2 + y^2 - 4x - 12y - 9 = 0$$

in the standard form for a circle. What is the center and radius of the circle?

3. 10 pts. Find the vertex of the parabola given by $f(x) = -2x^2 - 12x + 3$. In interval notation, what is the domain and range of the function?

4. 5 pts. each If a toy rocket is launched vertically upward from ground level with an initial velocity of 128 feet per second, then its height h after t seconds is given by the function

$$h(t) = -16t^2 + 128t.$$

(a) How long will it take the rocket to reach its maximum height?

(b) What is the maximum height?

(c) When will the rocket return to the ground?

5. 10 pts. Divide using long division: $(x^4 + 2x^3 - 5x - 6) \div (x^2 + 2x - 2)$.

6. 15 pts. Consider the equation

$$x^4 - 2x^2 - 16x - 15 = 0.$$

List all the possible rational roots. Use synthetic division to test the possible rational roots and find actual roots. Then find *all* solutions to the equation, real or complex.

7. 20 pts. Use the 7-step procedure used in homework to sketch a graph of the rational function

$$R(x) = \frac{x + 4}{x^2 - 16}.$$

The steps are: (1) Domain; (2) Symmetry; (3) Intercepts; (4) Vertical asymptotes and holes; (5) Horizontal/slant asymptote; (6) Plot additional points; (7) Graph.

8. 10 pts. each Solve each inequality, showing use of test values and the Intermediate Value Theorem. Put answers in interval notation.

(a) $(x + 1)(x - 2)(x + 3) > 0$

(b) $\frac{2}{x - 9} \geq 1$