The Rational Zero Test

Do all work on a separate sheet of paper!

In Exercises 1 – 4, use the Rational Zero Test to list all possible rational zeros of \( f \). Verify that the zeros of \( f \) shown on the graph are contained in the list.

1. \( f(x) = x^3 + 3x^2 - x - 3 \)
2. \( f(x) = x^3 - 4x^2 - 4x + 16 \)
3. \( f(x) = 2x^4 - 17x^3 + 35x^2 + 9x - 45 \)
4. \( f(x) = 4x^5 - 8x^4 - 5x^3 + 10x^2 + x - 2 \)

In Exercises 5 – 12, (a) list the possible rational zeros of \( f \), (b) use a graphing utility to graph \( f \) so that some of the possible zeros in part (a) can be disregarded, and (c) determine all the real zeros of \( f \).

5. \( f(x) = x^3 + x^2 - 4x - 4 \)
6. \( f(x) = -3x^3 + 20x^2 - 36x + 16 \)
7. \( f(x) = -4x^3 + 15x^2 - 8x - 3 \)

8. \( f(x) = 4x^3 - 12x^2 - x + 15 \)
9. \( f(x) = -2x^4 + 13x^3 - 21x^2 + 2x + 8 \)
10. \( f(x) = 4x^4 - 17x^2 + 4 \)
11. \( f(x) = 6x^3 - x^2 - 13x + 8 \)
12. \( f(x) = 4x^3 + 7x^2 - 11x - 18 \)

13. Find the equation of the quadratic function in standard form and find the vertex of the graph. \( f(x) = 40x + 4 + 4x^2 \)

14. Sketch the graph of the function. Identify the vertex. \( f(x) = (x - 4)^2 + 3 \)

15. Find the equation of a quadratic function with the vertex \( \left(0, \frac{1}{2}\right) \), that passes through the point \( \left(-2, \frac{25}{2}\right) \) and opens upward.

16. Write the standard form of the equation of the parabola graphed below.
17. The demand for saws depends on the price per saw. A manufacturer determines that the number of saws he can sell is
\[ d = -2p^2 + 288p - 160 \]
where \( p \) is the price per saw in dollars. At what price will the demand for saws be at a maximum?

[A] $72
[B] $40
[C] $144
[D] $20

18. Macro Manufacturing estimates that its profit \( P \) in hundreds of dollars is
\[ P = -3x^2 + 12x + 2 \]
where \( x \) is the number of units produced in thousands. How many units must be produced to obtain the maximum profit?

[A] 20 units
[B] 200 units
[C] 2 units
[D] 2000 units

19. A farmer has 932 meters of fencing available to enclose a rectangular portion of his land. One side of the rectangle being fenced lies along a river, so only three sides require fencing.

(a) Express the area \( A \) of the rectangle as a function of \( x \), where \( x \) is the length of the side parallel to the river.

(b) For what value of \( x \) is the area largest?

20. The height of an arrow shot into the air is
\[ h(t) = -16t^2 + 38.4t \]
where \( h(t) \) is the height in feet of the arrow above the ground \( t \) seconds after it is released. Find the maximum height the arrow reaches by graphing the function.