Name:___________________________

SM3 3.3: Graphing Polynomials with Technology

Problems: Find all the real roots of the given polynomials using a graphing utility, round to the nearest thousandth as necessary.

1) $y = x^3 + 4x^2 - 37x - 40$
$x = \{-8, -1, 5\}$

2) $f(x) = -x^3 + 27x^2 - 239x + 693$
$x = \{7, 9, 11\}$

3) $p(x) = x^3 - 4x^2 - 28x - 32$
$x = \{-2, 8\}$

4) $y = 24x^3 + 4x^2 - 116x - 56$
$x = \{-2, -.5, 2.333\}$

5) $s(x) = -4x^3 + 5x^2 + 8x - 10$
$x = \{1.25, -1.414, 1.414\}$

6) $m(x) = -4x^3 + 44x^2 + 3x - 33$
$x = \{11, -.866, .866\}$

7) $g(x) = x^3 - 4x^2 - 197x + 1230$
$x = \{-14.848, 6.981, 11.866\}$

8) $y = x^3 - 5x^2 + 4x - 20$
$x = \{5\}$

9) $f(x) = -x^3 + 52x^2 - 105x + 250$
$x = \{50\}$

10) $y = x^4 - 6x^3 - 327x^2 - 1424x - 1104$
$x = \{-12, -4, -1, 23\}$

11) $h(x) = x^4 + 6x^3 + 29x^2 + 24x + 100$
$\emptyset$

12) $y = -x^4 - 18x^3 + 174x^2 - 18x + 175$
$x = \{-25, 7\}$

13) $q(x) = x^4 + 14x^3 - 62x^2 - 182x + 85$
$x = \{-17, 5, -2.414, .414\}$

14) $p(x) = x^4 - 2x^2 - 2x + 2$
$x = \{.660, 1.569\}$

For what interval(s) of the domain is the graph a) positive and b) negative?

15) $y = x^3 - 4x^2 - 11x + 30$
a) $(-3, 2) \cup (5, \infty)$
b) $(-\infty, -3) \cup (2, 5)$

16) $f(x) = x^3 - 18x^2 + 96x - 160$
a) $(10, \infty)$
b) $(-\infty, 4) \cup (4, 10)$

17) $g(x) = x^3 - 15x + 4$
a) $(-4, .268) \cup (3.732, \infty)$
b) $(-\infty, -4) \cup (.268, 3.732)$

18) $p(x) = x^3 + 6x^2 - 6x - 136$
a) $(4, \infty)$
b) $(-\infty, 4)$

19) $y = x^4 + 4x^3 - 226x^2 - 460x + 6825$
a) $(-\infty, -15) \cup (-7, 5) \cup (13, \infty)$
b) $(-15, -7) \cup (5, 13)$

20) $q(x) = x^4 - 2x^3 + 14x^2 - 8x + 40$
a) $(-\infty, \infty)$
b) $\emptyset$

For each polynomial, find all relative extrema.

21) $h(x) = x^3 - 3x^2$
Max $(0,0)$, Min $(2, -4)$

22) $y = -x^3 + x^2 - 3$
Max $(.667, -2.852)$, Min $(0, -3)$

23) $f(x) = 3x^3 - 42x^2 + 18x - 294$
Max $(.219, -292.041)$, Min $(9.113, -1347.515)$

24) $r(x) = -x^4 + 3x^2 - 3x$
Max $(-1.424, 6.243)$

25) $q(x) = 7x^3 - 21x^2 - 14$
Max $(0, -14)$, Min $(2, -42)$

26) $g(x) = x^4 - x^2 - x + 4$
Min $(.885, 2.945)$

27) $f(x) = -x^4 + 3x^2 + x - 4$
Max $(1.301, -.486), (-1.130, -2.930)$
Min $(-.170, -4.084)$

28) $s(x) = x^4 - x^2 - x + 3$
Min $(.885, 1.945)$

For what interval(s) of the domain is the graph a) increasing and b) decreasing?

29) $y = 2x^4 + 2x^3 - 6x^2 - 4$
a) $(-1.656, 0) \cup (.906, \infty)$
b) $(-\infty, -1.656) \cup (0, .906)$

30) $p(x) = x^3 - 12x^2 + 45x - 48$
a) $(-\infty, 3) \cup (5, \infty)$
b) $(3, 5)$

31) $y = 5x^3 - 15x^2 + 20$
a) $(-\infty, 0) \cup (2, \infty)$
b) $(0, 2)$

32) $t(x) = -8x^4 + 8x^2 + 24$
a) $(-\infty, -.707) \cup (0, .707)$
b) $(-.707, 0) \cup (.707, \infty)$

33) Mr. Wytiaz wants to build a sound proof box that he can climb into when he has a headache. But he wants the sum of the length, width, and height to equal 15 ft and the length must be twice the width. Wytiaz gets a little claustrophobic sometimes, so he also wants to maximize the interior volume. Find the dimensions of the box that result in the maximum volume.

$l + w + h = 15$ and $l = 2w$

So, $2w + w + h = 15$, then we solve for h: $h = 15 - 3w$

$V = l \cdot w \cdot h$, substitute in the values for l and h

$V = (2w)(w)(15 - 3w)$, then plug this in your calculator to $y =$ as $(2x)(x)(15 - 3x)$ and find the max

$x = 3.333$, so the width is $w = 3.333\ ft$, so $l = 2w = 6.666\ ft$, and $h = 5.001\ ft$