Chapter 3 Review ANSWER KEY

1. $(x^3+x^2)\div(x-1)$

1	1	1	0	0
		1	2	2
	1	2	2	2

$\boxed{\text{\# of strips is } x^2+2x+2+2/x-1}$

2. $T(x) = N(x)\cdot C(x)$

$= (0.3x^2-1.6x+14)(-0.001x^2-0.06x+8.3)$

$= -0.0003x^4-0.018x^3+2.49x^2$

$+0.0016x^3+0.096x^2-13.28x$

$-0.014x^2-0.84x+116.2$

$\boxed{T(x) = -0.0003x^4-0.0164x^3+2.572x^2-14.12x+116.2}$

3. refer to page 186 #23 for a similar problem, if needed

$V(x) = (11-2x)(14-2x)(x)$

$= (154-50x+4x^2)(x)$

$\boxed{V(x) = 4x^3-50x^2+154x}$

a) maximum volume $= 140.04$ in.^{3}
length of side of square $= 2.04$ in.
} use graphing calculator to find maximum

4. x: length of box

$V = x(x-2)(x+5)$

$V = x(x^2+3x-10)$

$V = x^3+3x^2-10x$

$x^3+3x^2-10x = 24$

$x^3+3x^2-10x-24 = 0$

3	1	3	-10	-24
		3	18	24
	1	6	8	0

$x^2+6x+8=0$

$(x+2)(x+4)=0$

$x=3$, $\cancel{-2}$, $\cancel{-4}$

length is 3 inches

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5. $V_{ROCKET\ BODY} = V_{CYLINDER} + V_{CONE}$

$= \pi r^2(60) + \frac{1}{3}\pi r^2(2r)$

$$\frac{558\pi = 60\pi r^2 + \frac{2}{3}\pi r^3}{\pi}$$

$\frac{2}{3} r^3 + 60r^2 - 558 = 0$

radius = 3 cm

$$\begin{array}{r|rrrr} 3 & \frac{2}{3} & 60 & 0 & -558 \\ & & 2 & 186 & 558 \\ \hline & \frac{2}{3} & 62 & 186 & 0 \end{array}$$

$\frac{2}{3} r^2 + 62r + 186 = 0$

← solutions are negative

6. $(2x+y)(2x-y) = 4x^2 - y^2$

7.
$$\begin{array}{r} 6 - y^2 \\ 10 - y^2 \overline{)\,60 - 16y^2 + y^4} \\ \underline{-60 + 6y^2} \\ -10y^2 + y^4 \\ \underline{+10y^2 - y^4} \\ 0 \end{array}$$

$\boxed{6 - y^2}$

8.
$$\begin{array}{r|rrrrr} -5 & 1 & 6 & 6 & 0 & 0 \\ & & -5 & -5 & -5 & 25 \\ \hline & 1 & 1 & 1 & -5 & 25 \end{array}$$

$\boxed{x^3 + x^2 + x - 5 + 25/x+5}$

9. 5 real zeros (since there are 5 x-intercepts)

10. least possible degree: 5

\# of turning points: 4

\# of real zeros: 5

positive leading coefficient

as $x \to \infty$, $f(x) \to \infty$ } end behavior

as $x \to -\infty$, $f(x) \to -\infty$

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multiplicity of 3

11. $f(x)=0$ when $x=-1, 1, 2$ ← multiplicity of 2

multiplicity of 1

$f(x)=-(x+1)^3(x-1)(x-2)^2$

Make sure you have a negative leading coefficient!

12. $8y^3-4y^2-50y+25$

$4y^2(2y-1)-25(2y-1)$

$(4y^2-25)(2y-1)$

$\boxed{(2y+5)(2y-5)(2y-1)}$

13. $24n^2+3n^5$

$3n^2(8+n^3)$

$\boxed{3n^2(2+n)(4-2n+n^2)}$

Know your rules for factoring sums/differences of cubes!

14. $2x^4-2x^3-8x^2+8x$

$2x(x^3-x^2-4x+4)$

$x^2(x-1)-4(x-1)$

$(x^2-4)(x-1)$

$\boxed{2x(x+2)(x-2)(x-1)}$

15. y^5+27y^2

$y^2(y^3+27)$

$\boxed{y^2(y+3)(y^2-3y+9)}$

16.

3	2	-3	-8	-3
		6	9	3
	2	3	1	0

$2x^2+3x+1$

$(2x+1)(x+1)$

Given!

$\boxed{f(x)=(x-3)(2x+1)(x+1)}$

17.

7	3	-19	-22	56
		21	14	-56
	3	2	-8	0

$3x^2+2x-8$

$\boxed{f(x)=(x-7)(3x-4)(x+2}$

18. Possible rational zeros: $\pm 1, \pm 3, \pm 9$

19. Possible rational zeros: $\pm 1, \pm 2, \pm 4, \pm 8, \pm \frac{1}{3}, \pm \frac{2}{3}, \pm \frac{4}{3}, \pm \frac{8}{3}$

20. $g(x) = x^3 - x^2 - x + 1$ $\quad \{x = 1, -1\}$ (1: multiplicity of 2)

$$\begin{array}{r|rrrr} 1 & 1 & -1 & -1 & 1 \\ & & 1 & 0 & -1 \\ \hline & 1 & 0 & -1 & 0 \end{array}$$

$x^2 - 1 = 0 \qquad x = \pm 1$

21. $f(x) = 2x^3 - 5x^2 - 2x + 2$ $\quad \{x = 1/2,\ 1 \pm \sqrt{3}\}$

$$\begin{array}{r|rrrr} 1/2 & 2 & -5 & -2 & 2 \\ & & 1 & -2 & -2 \\ \hline & 2 & -4 & -4 & 0 \end{array}$$

$2x^2 - 4x - 4 = 0$

$x^2 - 2x - 2 = 0$

$x = \dfrac{2 \pm \sqrt{4 - 4(1)(-2)}}{2}$

$x = \dfrac{2 \pm 2\sqrt{3}}{2}$

22. $f(x) = x^3 - 2x - 4$ $\quad \{x = 2, -1 \pm i\}$

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -2 & -4 \\ & & 2 & 4 & 4 \\ \hline & 1 & 2 & 2 & 0 \end{array}$$

$x^2 + 2x + 2 = 0$

$x = \dfrac{-2 \pm \sqrt{4 - 4(1)(2)}}{2}$

$x = \dfrac{-2 \pm 2i}{2}$

23. $h(x) = 4x^4 + x^3 + 25x^2 + 7x - 21$ $\quad x = \{-1, 3/4, \pm i\sqrt{7}\}$

$$\begin{array}{r|rrrrr} -1 & 4 & 1 & 25 & 7 & -21 \\ & & -4 & 3 & -28 & 21 \\ \hline & 4 & -3 & 28 & -21 & 0 \end{array}$$

$$\begin{array}{r|rrrr} 3/4 & 4 & -3 & 28 & -21 \\ & & 3 & 0 & 21 \\ \hline & 4 & 0 & 28 & 0 \end{array}$$

$4x^2 + 28 = 0$

$x^2 = -7$

$x = \pm i\sqrt{7}$

24. $f(x) = (x+2)(x-i)(x+i)(x-\sqrt{3})(x+\sqrt{3})$

$= (x+2)(x^2+1)(x^2-3)$

$= (x+2)(x^4-2x^2-3)$

$f(x) = x^5 - 2x^3 - 3x + 2x^4 - 4x^2 - 6$

$\boxed{f(x) = x^5 + 2x^4 - 2x^3 - 4x^2 - 3x - 6}$

25. $f(x) = x[x-(4-i)][x-(4+i)]$

$f(x) = x[(x-4)+i][(x-4)-i]$

$f(x) = x[(x-4)^2 - i^2]$

$= x(x^2 - 8x + 17)$

$\boxed{f(x) = x^3 - 8x^2 + 17x}$

26. $f(x) = [x-(1+\sqrt{3})][x-(1-\sqrt{3})]$

$f(x) = [(x-1)-\sqrt{3}][(x-1)+\sqrt{3}]$

$= (x-1)^2 - 3$

$\boxed{f(x) = x^2 - 2x - 2}$

27. L.C. $= -6$, degree $= 4$, as $x \to \infty$, $r(x) \to -\infty$

as $x \to -\infty$, $r(x) \to -\infty$

28. L.C. $= -16$, degree $= 3$, as $x \to \infty$, $q(x) \to -\infty$

as $x \to -\infty$, $q(x) \to \infty$

29. max: 5.092, 13.494

min. 4.414

30. max: 0

min. −8.870

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$f(x) = -2x^4 + 7x^2 - 4$

31. a) $g(x) = f(1/4\, x)$ horizontal stretch by 4

$= -2(1/4\, x)^4 + 7(\frac{1}{4}x)^2 - 4$

$\boxed{g(x) = -1/128\, x^4 + 7/16\, x^2 - 4}$

graphs on separate page

b) $g(x) = 4f(x)$ vertical stretch by 4

$= 4(-2x^4 + 7x^2 - 4)$

$\boxed{g(x) = -8x^4 + 28x^2 - 16}$

32. a) $g(x) = f(x-5)$ horizontal shift right 5

$\boxed{g(x) = -2(x-5)^4 + 7(x-5)^2 - 4}$

b) $g(x) = 0.25 f(x)$ vertical compression by 1/4

$\boxed{g(x) = -1/2\, x^4 + 7/4\, x^2 - 1}$

33. $\boxed{a.\ g(x) = -4(x+2)^3 + 5}$

$f(x) = 4x^3 - 5$

b. $g(x) = f(5x) + 1$

$= 4(5x)^3 - 5 + 1$

$\boxed{g(x) = 500x^3 - 4}$

c. $g(x) = 3f(x-3)$

$= 3(4(x-3)^3 - 5)$

$\boxed{g(x) = 12(x-3)^3 - 15}$

d. $g(x) = f(-x)$

$\boxed{g(x) = -4x^3 - 5}$