Friendship Jr. High School
Accelerated Math Program

Algebra

4

UNIT #10
Radicals

UNIT #11
Quadratic Functions & Equations

UNIT #12
Rational Expressions

10.1
Answer Key

① $\sqrt{36} = \boxed{6}$

② $\sqrt{49} = \boxed{7}$

③ $-\sqrt{81} = \boxed{-9}$

④ $-\sqrt{64} = \boxed{-8}$

⑤ $\pm\sqrt{9} = \boxed{\pm 3}$

⑥ $\pm\sqrt{16} = \boxed{\pm 4}$

⑦ $\sqrt{4/9} = \boxed{2/3}$

⑧ $\sqrt{25/36} = \boxed{5/6}$

⑨ $\sqrt{24} = \sqrt{(2\cdot 2)\cdot 2\cdot 3} = \boxed{2\sqrt{6}}$

⑩ $\sqrt{45} = \sqrt{(3\cdot 3)\cdot 5} = \boxed{3\sqrt{5}}$

⑪ $\sqrt{48} = \sqrt{(2\cdot 2)(2\cdot 2)\cdot 3} = \boxed{4\sqrt{3}}$

⑫ $\sqrt{80} = \sqrt{(2\cdot 2)(2\cdot 2)5} = \boxed{4\sqrt{5}}$

⑬ $-\sqrt{150} = -\sqrt{2\cdot 3(5\cdot 5)} = \boxed{-5\sqrt{6}}$

⑭ $-\sqrt{162} = -\sqrt{2(3\cdot 3)(3\cdot 3)} = \boxed{-9\sqrt{2}}$

⑮ $\sqrt{8n} = \sqrt{(2\cdot 2)2\cdot n} = \boxed{2\sqrt{2n}}$

⑯ $\sqrt{20x} = \sqrt{(2\cdot 2)\cdot 5\cdot x} = \boxed{2\sqrt{5x}}$

⑰ $\sqrt{40n^3} = \sqrt{(2\cdot 2)\cdot 2\cdot 5\cdot n^3} = \boxed{2n\sqrt{10n}}$

⑱ $\sqrt{12a^3} = \sqrt{(2\cdot 2)3a^3} = \boxed{2a\sqrt{3a}}$

⑲ $\sqrt{75n^4} = \sqrt{3(5\cdot 5)\cdot n^4} = \boxed{5n^2\sqrt{3}}$

⑳ $\sqrt{60a^4b^4} = \sqrt{(2\cdot 2)3\cdot 5\cdot a^4b^4} = \boxed{2a^2b^2\sqrt{15}}$

㉑ $\sqrt{18n^2} = \sqrt{2(3\cdot 3)n^2} = \boxed{3|n|\sqrt{2}}$

㉒ $\sqrt{54x^2} = \sqrt{2(3\cdot 3)3\cdot x^2} = \boxed{3|x|\sqrt{6}}$

㉓ $\sqrt{90a^3b^2} = \sqrt{2\cdot(3\cdot 3)\cdot 5\cdot a^3b^2}$

$\boxed{3a\,|b|\sqrt{10a}}$ "a" cannot be negative or original radicand will be negative. "b" is independent and can be negative.

㉔ $\sqrt{50x^2y^5} = \sqrt{2(5\cdot 5)\cdot x^2y^5}$

$\boxed{5|x|\,y^2\sqrt{2y}}$ "x" is independent and can be negative in the original radicand. "y" must be positive (odd exponent).

㉕ $\sqrt{72a^3b^3} = \sqrt{(2\cdot 2)2\cdot(3\cdot 3)\cdot a^3b^3}$

$\boxed{6ab\sqrt{2ab}}$ "a" and "b" both have odd (3) exponents. They are dependent, both negative or both positive. If both are negative, no absolute value is needed.

㉖ $\sqrt{32x^4y^3} = \sqrt{(2\cdot 2)(2\cdot 2)2\cdot x^4y^3}$

$\boxed{4x^2y\sqrt{2y}}$ "y" cannot be negative or original radicand would be negative.

㉗ $\sqrt{28a^6b^4} = \sqrt{(2\cdot 2)7\cdot a^6b^4}$

$\boxed{2b^2|a^3|\sqrt{7}}$ "a" or "b" (or both) could be negative. The even exponent in the answer protects "b."

㉘ $\sqrt{24n^3m^5} = \sqrt{(2\cdot 2)2\cdot 3\cdot n^3m^5}$

$\boxed{2m^2|n|\sqrt{6nm}}$ Variables both have odd exponents in original radicand, making them dependent (both must have same sign). If they are negative, "n" needs to be protected in the answer because of the odd exponent (1).

(29) $\sqrt{45a^4b^2} = \sqrt{3\cdot3\cdot5\cdot a^4b^2}$

$\boxed{3a^2|b|\sqrt{5}}$ The even exponents in the original radicand allow both variables to be positive or negative independent of each other. "b" has to be protected in the answer.

(30) $\sqrt{12x^3y^4} = \sqrt{2\cdot2\cdot3\cdot x^3y^4}$

$\boxed{2xy^2\sqrt{3x}}$ "x" cannot be negative. "y" is protected because of the even exponent (2) in answer.

(31) $\sqrt{20a^2b^4} = \sqrt{2\cdot2\cdot5\cdot a^2b^4}$

$\boxed{2b^2|a|\sqrt{5}}$ Variables are both independent (even exponents in original radicand). Either could be negative. "a" needs protection.

(32) $\sqrt{8n^3m^2} = \sqrt{2\cdot2\cdot2\cdot n^3m^2}$

$\boxed{2n|m|\sqrt{2n}}$ "n" cannot be negative. "m" can be and must be protected.

(33) $\sqrt{80x^3y^3} = \sqrt{2\cdot2\cdot2\cdot5\cdot x^3y^3}$

$\boxed{4xy\sqrt{5xy}}$ Variables are dependent (both have same signs, odd exponents in original radicand). No absolute value signs needed if both are negative in answer.

(34) $\sqrt{44n^5m^2} = \sqrt{2\cdot2\cdot11\cdot n^5m^2}$

$\boxed{2n^2|m|\sqrt{11n}}$ "n" has odd exponent in original radicand and therefore cannot be negative. "m" can be (independent) and must be protected.

(35) $\sqrt{a^3b^5c^2} = \boxed{b^2|ac|\sqrt{ab}}$

"c" is independent and must be protected (even exponent in original radicand). "a" and "b" are dependent, both must have same sign. Even exponent in answer (2) protects "b."

(36) $\sqrt{x^4y^6z^3} = \boxed{x^2z|y^3|\sqrt{z}}$

"x" and "y" are independent. "y" must be protected in answer due to odd exponent (3). "z" cannot be negative (only odd exponent in original radicand).

(37) $\sqrt{x^5y^3z^4} = \boxed{|x^2z^2|y|\sqrt{xy}}$

"z" is independent but even exponent in answer (2) protects it. "x" and "y" are dependent, both must have same signs. "x" is protected (even exponent in answer). "y" needs absolute value bars.

(38) $\sqrt{a^3b^3c^3} = \boxed{abc\sqrt{abc}}$

Because all variables have odd exponents in original radicand, either they are all positive or exactly two of them are negative. If two are negative, the answer is positive and needs no absolute value bars.

(39) $\sqrt{n^2m^3p} = \boxed{|n|m|\sqrt{mp}}$

"n" is independent, could be negative. "m" and "p" are dependent (must have same sign). Since "n" or "m" could be negative, both must be protected.

(40) $\sqrt{x^3y^2z^3} = \boxed{xz|y|\sqrt{xz}}$

"y" is independent (even exponent in original radicand) and must be protected in the final answer. "x" and "z" are dependent, must have same sign. Even if negative, xz = a positive and needs no absolute value bars.

10.2
Answer Key

① $(\sqrt{2})(\sqrt{3}) = \boxed{\sqrt{6}}$

② $(\sqrt{5})(\sqrt{7}) = \boxed{\sqrt{35}}$

③ $(\sqrt{6})(\sqrt{2}) = \sqrt{12} = \boxed{2\sqrt{3}}$

④ $(\sqrt{8})(\sqrt{3}) = \sqrt{24} = \boxed{2\sqrt{6}}$

⑤ $\sqrt{2}(\sqrt{3}+\sqrt{8}) = \sqrt{6}+\sqrt{16} = \boxed{\sqrt{6}+4}$

⑥ $\sqrt{3}(\sqrt{3}-\sqrt{2}) = \sqrt{9}-\sqrt{6} = \boxed{3-\sqrt{6}}$

⑦ $2\sqrt{2}+\sqrt{18} = 2\sqrt{2}+3\sqrt{2} = \boxed{5\sqrt{2}}$

⑧ $4\sqrt{3}-2\sqrt{12} = 4\sqrt{3}-4\sqrt{3} = \boxed{0}$

⑨ $2\sqrt{50}-3\sqrt{32} = 10\sqrt{2}-12\sqrt{2} = \boxed{-2\sqrt{2}}$

⑩ $3\sqrt{27}-5\sqrt{48} = 9\sqrt{3}-20\sqrt{3} = \boxed{-11\sqrt{3}}$

⑪ $3\sqrt{28}-8\sqrt{63} = 6\sqrt{7}-24\sqrt{7} = \boxed{-18\sqrt{7}}$

⑫ $3\sqrt{2}(2\sqrt{6}-\sqrt{24})$

$6\sqrt{12}-3\sqrt{48}$

$12\sqrt{3}-12\sqrt{3}$

$\boxed{0}$

⑬ $2\sqrt{3}(\sqrt{15}+2\sqrt{3})$

$2\sqrt{45}+4\sqrt{9}$

$6\sqrt{5}+4(3)$

$\boxed{6\sqrt{5}+12}$

⑭ $2\sqrt{2}-3\sqrt{18}+2\sqrt{6}$

$2\sqrt{2}-9\sqrt{2}+2\sqrt{6} = \boxed{-7\sqrt{2}+2\sqrt{6}}$

⑮ $4\sqrt{3}+2\sqrt{8}-3\sqrt{12}$

$4\sqrt{3}+4\sqrt{2}-6\sqrt{3} = \boxed{4\sqrt{2}-2\sqrt{3}}$

⑯ $-\sqrt{8x^3y^4} = \boxed{-2xy^2\sqrt{2x}}$

"y" is independent, can be negative but is protected by even exponent (2) in the answer. "x" cannot be negative (odd exponent in original radicand)

⑰ $\sqrt{12a^5b^3c^2} = \boxed{2a^2|b|c|\sqrt{3ab}}$

"c" is independent, could be negative and needs protection in the answer. "a" and "b" are dependent, must have same sign, "b" must be protected.

⑱ $\pm\sqrt{20n^3m^3} = \boxed{\pm 2nm\sqrt{5nm}}$

Both variables have odd exponents in original radicand. They are dependent, same sign. No bars needed since both are positive or both are negative.

⑲ $\sqrt{x^2y^2z^3} = \boxed{z|xy|\sqrt{z}}$

"z" cannot be negative (only odd exponent in original radicand). "x" and "y" are independent. Since one or the other could be negative, both need to be protected.

⑳ $\sqrt{a^3b^4c^5} = \boxed{b^2c^2|a|\sqrt{ac}}$

"b" and "c" are protected by even exponents in the answer. "a" can be negative if "c" is negative, but "a" must be protected (odd exponent in answer).

10.3
Answer Key

① $\frac{\sqrt{8}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{24}}{3} = \boxed{\frac{2\sqrt{6}}{3}}$

② $\frac{\sqrt{10}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{20}}{2} = \frac{2\sqrt{5}}{2} = \boxed{\sqrt{5}}$

③ $\frac{2\sqrt{5}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{2\sqrt{10}}{2} = \boxed{\sqrt{10}}$

④ $\frac{3\sqrt{6}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{3\sqrt{18}}{3} = \sqrt{18} = \boxed{3\sqrt{2}}$

⑤ $\frac{3\sqrt{2}}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{3\sqrt{12}}{6} = \frac{6\sqrt{3}}{6} = \boxed{\sqrt{3}}$

⑥ $\frac{2\sqrt{3}}{\sqrt{8}} \cdot \frac{\sqrt{8}}{\sqrt{8}} = \frac{2\sqrt{24}}{8} = \frac{4\sqrt{6}}{8} = \boxed{\frac{\sqrt{6}}{2}}$

⑦ $\frac{1}{6+\sqrt{3}} \cdot \frac{6-\sqrt{3}}{6-\sqrt{3}} = \frac{6-\sqrt{3}}{36-3} = \boxed{\frac{6-\sqrt{3}}{33}}$

⑧ $\frac{1}{7-\sqrt{2}} \cdot \frac{7+\sqrt{2}}{7+\sqrt{2}} = \frac{7+\sqrt{2}}{49-2} = \boxed{\frac{7+\sqrt{2}}{47}}$

⑨ $\frac{\sqrt{3}}{2-\sqrt{3}} \cdot \frac{2+\sqrt{3}}{2+\sqrt{3}} = \frac{2\sqrt{3}+3}{4-3} = \boxed{2\sqrt{3}+3}$

⑩ $\frac{\sqrt{5}}{5+\sqrt{5}} \cdot \frac{5-\sqrt{5}}{5-\sqrt{5}} = \frac{5\sqrt{5}-5}{25-5}$

$\frac{5\sqrt{5}-5}{20} = \boxed{\frac{\sqrt{5}-1}{4}}$

⑪ $\sqrt{6}+\sqrt{\frac{2}{3}} \quad \frac{\sqrt{2}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{6}}{3}$

$\sqrt{6}+\frac{\sqrt{6}}{3} = \frac{3\sqrt{6}}{3}+\frac{\sqrt{6}}{3} = \boxed{\frac{4\sqrt{6}}{3}}$

⑫ $\sqrt{7}+\sqrt{\frac{1}{7}} \quad \frac{\sqrt{1}}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{7}}{7}$

$\sqrt{7}+\frac{\sqrt{7}}{7} = \frac{7\sqrt{7}}{7}+\frac{\sqrt{7}}{7} = \boxed{\frac{8\sqrt{7}}{7}}$

⑬ $14\sqrt{\frac{3}{2}}+9\sqrt{\frac{2}{3}} \quad \frac{\sqrt{3}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{6}}{2}$

$14\left(\frac{\sqrt{6}}{2}\right)+9\left(\frac{\sqrt{6}}{3}\right) \quad \frac{\sqrt{2}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{6}}{3}$

$7\sqrt{6}+3\sqrt{6} = \boxed{10\sqrt{6}}$

⑭ $3\sqrt{\frac{7}{4}}-10\sqrt{\frac{1}{7}} \quad \frac{\sqrt{7}}{\sqrt{4}} = \frac{\sqrt{7}}{2}$

$3\left(\frac{\sqrt{7}}{2}\right)-10\left(\frac{\sqrt{7}}{7}\right) \quad \frac{\sqrt{1}}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{7}}{7}$

$\left(\frac{3\sqrt{7}}{2}\right)\cdot\frac{7}{7}-\left(\frac{10\sqrt{7}}{7}\right)\cdot\frac{2}{2}$ establish a common denominator

$\frac{21\sqrt{7}}{14}-\frac{20\sqrt{7}}{14} = \boxed{\frac{\sqrt{7}}{14}}$

⑮ $\sqrt{12a^2b^2} = \boxed{2|ab|\sqrt{3}}$

Both variables are independent, could be negative. Since only one could be negative, both need to be protected.

⑯ $-\sqrt{n^3m^5p} = \boxed{-m^2|n|\sqrt{nmp}}$

All three variables in the original radicand have odd exponents which means all are positive or exactly two are negative. In the solution, m^2 is protected (even exponent). "n" could be negative and needs bars. The negative sign is attached at the very end.

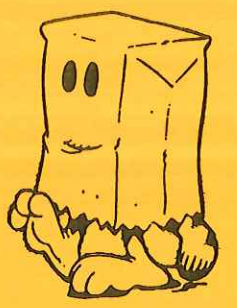
⑰ $-\sqrt{8x^2y^3z^6} = \boxed{-2y|xz^3|\sqrt{2y}}$

"x" and "z" are independent (even exponents in original radicand). Both can be negative (or neither or only one). Both must be protected in the answer. "y" cannot be negative (only odd exponent in original radicand).

⑱ $\sqrt{a^5b^6c^2} = \boxed{a^2|b^3c|\sqrt{a}}$

"b" and "c" are independent (even exponents in original radicand). Both can be negative (or neither or only one). Since both have odd exponents in the answer, both need to be protected. "a" cannot be negative (only odd exponent in orginal radicand).

10.4
Answer Key



① $\sqrt{264.0000}$

$$\begin{array}{r} 16.24 \\ 1 \\ 26\overline{)164} \\ 156 \\ 322\overline{)800} \\ 644 \\ 3244\overline{)15600} \\ 12976 \end{array}$$

≈ 16.2

② $\sqrt{586.0000}$

$$\begin{array}{r} 24.20 \\ 4 \\ 44\overline{)186} \\ 176 \\ 482\overline{)1000} \\ 964 \\ 4840\overline{)3600} \\ 0 \end{array}$$

≈ 24.2

③ $\sqrt{2924.0000}$

$$\begin{array}{r} 54.07 \\ 25 \\ 104\overline{)424} \\ 416 \\ 1080\overline{)800} \\ 0 \\ 10807\overline{)80000} \\ 75649 \end{array}$$

≈ 54.1

④ $\sqrt{1963.0000}$

$$\begin{array}{r} 44.30 \\ 16 \\ 84\overline{)363} \\ 336 \\ 883\overline{)2700} \\ 2649 \\ 8860\overline{)5100} \\ 0 \end{array}$$

≈ 44.3

⑤ $\sqrt{3620.0000}$

$$\begin{array}{r} 60.16 \\ 36 \\ 120\overline{)20} \\ 0 \\ 1201\overline{)2000} \\ 1201 \\ 12026\overline{)79900} \\ 72156 \end{array}$$

≈ 60.2

⑥ $\sqrt{4126.0000}$

$$\begin{array}{r} 64.23 \\ 36 \\ 124\overline{)526} \\ 496 \\ 1282\overline{)3000} \\ 2564 \\ 12843\overline{)43600} \\ 38529 \end{array}$$

≈ 64.2

⑦ $\sqrt{32a^2b^3} = \boxed{4b|a|\sqrt{2b}}$

"a" is independent, could be negative, must be protected in answer.

⑧ $\sqrt{24x^3y^3z^2} = \boxed{2xy|z|\sqrt{6xy}}$

"z" is independent, could be negative, must be protected in answer. "x" and "y" are dependent (same sign). If both negative, no bars needed.

⑨ $4\sqrt{2}(\sqrt{8}-3\sqrt{18})$

$4\sqrt{16}-12\sqrt{36}$

$4(4)-12(6) = \boxed{-56}$

⑩ $\frac{\sqrt{6}}{2-\sqrt{3}} \cdot \frac{2+\sqrt{3}}{2+\sqrt{3}} = \frac{2\sqrt{6}+\sqrt{18}}{4-3}$

$\boxed{2\sqrt{6}+3\sqrt{2}}$

⑪ $\frac{2\sqrt{2}}{\sqrt{8}-2} \cdot \frac{\sqrt{8}+2}{\sqrt{8}+2} = \frac{2\sqrt{16}+4\sqrt{2}}{4}$

$\frac{2(4)+4\sqrt{2}}{4} = \frac{8+4\sqrt{2}}{4}$

$\boxed{2+\sqrt{2}}$

10.5
Answer Key

① $27 = \sqrt{729}$, $\sqrt{739}$, $28 = \sqrt{784}$ } 55 } 10 → $27\frac{10}{55}$ → $\boxed{27\frac{2}{11}}$

② $34 = \sqrt{1156}$, $\sqrt{1179}$, $35 = \sqrt{1225}$ } 69 } 23 → $34\frac{23}{69}$ → $\boxed{34\frac{1}{3}}$

③ $37 = \sqrt{1369}$, $\sqrt{1419}$, $38 = \sqrt{1444}$ } 75 } 50 → $37\frac{50}{75}$ → $\boxed{37\frac{2}{3}}$

④ $17 = \sqrt{289}$, $\sqrt{314}$, $18 = \sqrt{324}$ } 35 } 25 → $17\frac{25}{35}$ → $\boxed{17\frac{5}{7}}$

⑤ $61 = \sqrt{3721}$, $\sqrt{3754}$, $62 = \sqrt{3844}$ } 123 } 33 → $61\frac{33}{123}$ → $\boxed{61\frac{11}{41}}$

⑥ $19 = \sqrt{361}$, $\sqrt{374}$, $20 = \sqrt{400}$ } 39 } 13 → $19\frac{13}{39}$ → $\boxed{19\frac{1}{3}}$

⑦ $22 = \sqrt{484}$, $\sqrt{509}$, $23 = \sqrt{529}$ } 45 } 25 → $22\frac{25}{45}$ → $\boxed{22\frac{5}{9}}$

⑧ $67 = \sqrt{4489}$, $\sqrt{4579}$, $68 = \sqrt{4624}$ } 135 } 90 → $67\frac{90}{135}$ → $\boxed{67\frac{2}{3}}$

⑨ $\sqrt{8n^3m^5p^2} = \boxed{2m^2|np|\sqrt{2nm}}$

"p" is independent, could be negative, needs to be protected. "n" and "m" are dependent. If both are negative, "m" is protected by an even exponent in the solution; "n" is not.

⑩ $\sqrt{12a^5b^6c^3} = \boxed{2a^2|b^3c|\sqrt{3ac}}$

"b" is independent, could be negative, needs protection (odd exponent in solution). "a" and "c" are dependent. If both are negative, "c" needs protection (odd exponent in solution).

⑪ $2\sqrt{3}(3\sqrt{12}-\sqrt{8})$

$6\sqrt{36}-2\sqrt{24}$

$6(6)-2(2\sqrt{6}) = \boxed{36-4\sqrt{6}}$

⑫ $4\sqrt{2}-4\sqrt{20}+3\sqrt{18}$

$4\sqrt{2}-4(2\sqrt{5})+3(3\sqrt{2})$

$4\sqrt{2}-8\sqrt{5}+9\sqrt{2} = \boxed{13\sqrt{2}-8\sqrt{5}}$

⑬ $\frac{3\sqrt{3}}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{3\sqrt{18}}{6} = \frac{3(3\sqrt{2})}{6}$

$\frac{9\sqrt{2}}{6} = \boxed{\frac{3\sqrt{2}}{2}}$

⑭ $\frac{3\sqrt{2}}{3-2\sqrt{2}} \cdot \frac{3+2\sqrt{2}}{3+2\sqrt{2}} = \frac{9\sqrt{2}+6(2)}{9-4(2)}$

$\frac{9\sqrt{2}+12}{9-8} = \boxed{9\sqrt{2}+12}$

⑮ $\frac{\sqrt{2}-3}{\sqrt{8}} = \frac{\sqrt{2}-3}{2\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \boxed{\frac{2-3\sqrt{2}}{4}}$

⑯
$$\begin{array}{r} 35.07 \\ \sqrt{1230.0000} \\ 9 \\ 65 \overline{)330} \\ 325 \\ 701 \overline{)500} \\ 0 \\ 7007 \overline{)50000} \\ 49049 \end{array}$$

$\boxed{\approx 35.1}$

10.6
Answer Key

① $\sqrt{n} = 7$

$\boxed{n = 49}$

② $\sqrt{x} = 8$

$\boxed{x = 64}$

③ $\sqrt{4x+1} = 3$

$4x+1 = 9$

$4x = 8$

$\boxed{x = 2}$

④ $\sqrt{2x+7} = 5$

$2x+7 = 25$

$2x = 18$

$\boxed{x = 9}$

⑤ $\sqrt{2n+1} = 0$

$\sqrt{2n} = -1$

$\boxed{\text{no real solutions}}$

⑥ $\sqrt{a}+3 = 1$

$\sqrt{a} = -2$

$\boxed{\text{no real solutions}}$

⑦ $\sqrt{8x+1} - 5 = 0$

$\sqrt{8x+1} = 5$

$8x+1 = 25$

$8x = 24$

$\boxed{x = 3}$

⑧ $\sqrt{2n-5} + 1 = 6$

$\sqrt{2n-5} = 5$

$2n-5 = 25$

$2n = 30$

$\boxed{n = 15}$

⑨ $\sqrt{n} = 3\sqrt{5}$

$n = (3\sqrt{5})^2$

$n = (9)(5)$

$\boxed{n = 45}$

⑩ $3\sqrt{7} = \sqrt{c}$

$(3\sqrt{7})^2 = c$

$(9)(7) = c$

$\boxed{c = 63}$

⑪ $5\sqrt{2n^2-28} = 20$

$\sqrt{2n^2-28} = 4$

$2n^2-28 = 16$

$2n^2 = 44$

$n^2 = 22$

$\boxed{n = \pm\sqrt{22}}$

⑫ $4\sqrt{3x^2-15} = 12$

$\sqrt{3x^2-15} = 3$

$3x^2-15 = 9$

$3x^2 = 24$

$x^2 = 8$

$\boxed{x = \pm 2\sqrt{2}}$

⑬ $\sqrt{n+2} = n-4$

$n+2 = (n-4)^2$

$n+2 = n^2-8n+16$

$0 = n^2-9n+14$

$(n-7)(n-2) = 0$

$\boxed{n = 7}$ ✓ $\quad$ ~~2~~

2 does not check

⑭ $\sqrt{1-2x} = 1+x$

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

$1-2x = 1+2x+x^2$

$0 = x^2+4x$

$x(x+4) = 0$

$\boxed{x = 0}$ $\quad$ ~~-4~~

-4 does not check

⑮ $4 + \sqrt{x-2} = x$

$\sqrt{x-2} = x-4$

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

$x-2 = x^2-8x+16$

$0 = x^2-9x+18$

$(x-6)(x-3) = 0$

$\boxed{x = 6}$ ✓ $\quad$ ~~3~~

3 does not check

⑯ $n + \sqrt{n^2+3} = 3n$

$\sqrt{n^2+3} = 2n$

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

$n^2+3 = 4n^2$

$0 = 3n^2-3$

$3(n^2-1) = 0$

$3(n-1)(n+1) = 0$

$\boxed{n = 1}$ ✓ $\quad$ ~~-1~~

-1 does not check

10.7
Answer Key

① $2^2+6^2=x^2$
$4+36=x^2$
$x^2=40$
$x=\sqrt{40}$
$\boxed{2\sqrt{10}\text{ m}}$

② $x^2+8^2=12^2$
$x^2+64=144$
$x^2=80$
$x=\sqrt{80}$
$\boxed{4\sqrt{5}\text{m}}$

③ $x^2+(6\sqrt{2})^2=10^2$
$x^2+(36)(2)=100$
$x^2=28$
$x=\sqrt{28}$
$\boxed{2\sqrt{7}\text{m}}$

④ $x^2+(4\sqrt{6})^2=12^2$
$x^2+(16)(6)=144$
$x^2=48$
$x=\sqrt{48}$
$\boxed{4\sqrt{3}\text{ m}}$

⑤ $(3\sqrt{2})^2+(3\sqrt{3})^2=x^2$
$(9)(2)+(9)(3)=x^2$
$x^2=45$
$x=\sqrt{45}$
$\boxed{3\sqrt{5}\text{ m}}$

⑥ $8^2+(4\sqrt{2})^2=x^2$
$64+(16)(2)=x^2$
$x^2=96$
$x=\sqrt{96}$
$\boxed{4\sqrt{6}\text{m}}$

⑦ $(-4,2)(4,17)$
$d=\sqrt{(-4-4)^2+(2-17)^2}$
$d=\sqrt{64+225}=\boxed{17}$

⑧ $(5,-1)(11,7)$
$d=\sqrt{(5-11)^2+(-1-7)^2}$
$d=\sqrt{36+64}=\boxed{10}$

⑨ $(7,-9)(4,-3)$
$d=\sqrt{(7-4)^2+(-9-3)^2}$
$d=\sqrt{9+36}=\sqrt{45}$
$\boxed{3\sqrt{5}}$

⑩ $\sqrt{4x}-3=3$
$\sqrt{4x}=6$
$4x=36$
$\boxed{x=9}$

⑪ $n+\sqrt{n^2-2n}=3n-4$
$\sqrt{n^2-2n}=2n-4$
$n^2-2n=(2n-4)^2$
$n^2-2n=4n^2-16n+16$
$0=3n^2-14n+16$
$3n^2-6n-8n+16=0$
$3n(n-2)-8(n-2)=0$
$(n-2)(3n-8)=0$
$\boxed{n=2,\ 8/3}$ both answers check

⑫ $\sqrt{18a^3b^2c^5}$
$\boxed{3c^2|ab|\sqrt{2ac}}$
"c" is protected by even exponent in the solution. "b" and "c" are dependent (same sign). "c" must be protected if both dependent variables are negative. "b" is independent, can be negative, must be protected.

⑬ $3\sqrt{2}(\sqrt{8}-4\sqrt{2})$
$3\sqrt{16}-12(2)$
$3(4)-24=\boxed{-12}$

⑭ $6\sqrt{2}-2\sqrt{32}$
$6\sqrt{2}-2(4\sqrt{2})$
$6\sqrt{2}-8\sqrt{2}=\boxed{-2\sqrt{2}}$

⑮ $\frac{\sqrt{3}-2}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}}=\boxed{\frac{3-2\sqrt{3}}{3}}$

⑯ $\frac{2}{6-\sqrt{3}}\cdot\frac{6+\sqrt{3}}{6+\sqrt{3}}=\frac{12+2\sqrt{3}}{36-3}=\boxed{\frac{12+2\sqrt{3}}{33}}$

⑰ $\sqrt{642.0000}\approx\boxed{25.3}$

$$\begin{array}{r} 25.33 \\ \sqrt{642.0000} \end{array}$$
$$\begin{array}{r} 4 \\ 4\boxed{5}\ \overline{)\ 242} \end{array}$$
$$\begin{array}{r} 225 \\ 50\boxed{3}\ \overline{)\ 1700} \end{array}$$
$$\begin{array}{r} 1509 \\ 506\boxed{3}\ \overline{)\ 19100} \end{array}$$
$$15189$$

⑱ $24 = \sqrt{576}$, $\sqrt{590}$, $25 = \sqrt{625}$ → $24\frac{14}{49}$ → $\boxed{24\frac{2}{7}}$

Unit 10
REVIEW
Answer Key

① $-\sqrt{180} = \boxed{-6\sqrt{5}}$

② $\pm\sqrt{300} = \boxed{\pm 10\sqrt{3}}$

③ $\sqrt{60n^3} = \boxed{2n\sqrt{15n}}$

④ $\sqrt{80n^7} = \boxed{4n^3\sqrt{5n}}$

⑤ $\sqrt{120a^2b^3} = \boxed{2b|a|\sqrt{30b}}$

⑥ $\sqrt{96x^3y^4z^5} = \boxed{4y^2z^2|x|\sqrt{6xz}}$

⑦ $\sqrt{200n^7m^6p^5} = \boxed{10p^2|n^3m^3|\sqrt{2np}}$

⑧ $\sqrt{288x^7y^7z^4} = \boxed{12x^3y^3z^2\sqrt{2xy}}$

⑨ $\sqrt{12a^5b^6c^7d^8} = \boxed{2a^2d^4|b^3c^3|\sqrt{3ac}}$

⑩ $\sqrt{20w^4x^3y^5z^7} = \boxed{2w^2y^2|xz^3|\sqrt{5xyz}}$

⑪ $(2\sqrt{6})(2\sqrt{2}) = 4\sqrt{12} = 4(2\sqrt{3}) = \boxed{8\sqrt{3}}$

⑫ $(5\sqrt{3})(4\sqrt{8}) = 20\sqrt{24} = 20(2\sqrt{6}) = \boxed{40\sqrt{6}}$

⑬ $\sqrt{3}(2\sqrt{6}-\sqrt{3}) = 2\sqrt{18}-3 = 2(3\sqrt{2})-3$
$\boxed{6\sqrt{2}-3}$

⑭ $\sqrt{5}(3\sqrt{10}-\sqrt{8})$
$3\sqrt{50}-\sqrt{40}$
$3(5\sqrt{2})-2\sqrt{10}$
$\boxed{15\sqrt{2}-2\sqrt{10}}$

⑮ $2\sqrt{8}-\sqrt{32}+\sqrt{2}$
$2(2\sqrt{2})-4\sqrt{2}+\sqrt{2}$
$4\sqrt{2}-4\sqrt{2}+\sqrt{2}$
$\boxed{\sqrt{2}}$

⑯ $\sqrt{5}+2\sqrt{20}-3\sqrt{45}$
$\sqrt{5}+2(2\sqrt{5})-3(3\sqrt{5})$
$\sqrt{5}+4\sqrt{5}-9\sqrt{5} = \boxed{-4\sqrt{5}}$

⑰ $6\sqrt{18}-4\sqrt{50}$
$6(3\sqrt{2})-4(5\sqrt{2})$
$18\sqrt{2}-20\sqrt{2} = \boxed{-2\sqrt{2}}$

⑱ $\sqrt{125}-3\sqrt{20}$
$5\sqrt{5}-3(2\sqrt{5})$
$5\sqrt{5}-6\sqrt{5} = \boxed{-\sqrt{5}}$

⑲ $\frac{3\sqrt{2}}{\sqrt{6}}\cdot\frac{\sqrt{6}}{\sqrt{6}} = \frac{3\sqrt{12}}{6} = \frac{3(2\sqrt{3})}{6}$

$\frac{6\sqrt{3}}{6} = \boxed{\sqrt{3}}$

⑳ $\frac{4\sqrt{6}}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}} = \frac{4\sqrt{18}}{3} = \frac{4(3\sqrt{2})}{3}$

$\frac{12\sqrt{2}}{3} = \boxed{4\sqrt{2}}$

㉑ $\frac{2\sqrt{7}}{\sqrt{7}-3}\cdot\frac{\sqrt{7}+3}{\sqrt{7}+3} = \frac{2(7)+6\sqrt{7}}{7-9}$

$\frac{14+6\sqrt{7}}{-2} = \boxed{-7-3\sqrt{7}}$

㉒ $\frac{3\sqrt{3}}{3-\sqrt{3}}\cdot\frac{3+\sqrt{3}}{3+\sqrt{3}} = \frac{9\sqrt{3}+3(3)}{9-3}$

$\frac{9\sqrt{3}+9}{6} = \boxed{\frac{3\sqrt{3}+3}{2}}$

㉓ $\sqrt{18}-\frac{\sqrt{1}}{\sqrt{8}}$ $\qquad \frac{\sqrt{1}}{\sqrt{8}}\cdot\frac{\sqrt{8}}{\sqrt{8}} = \frac{\sqrt{8}}{8}$

$3\sqrt{2}-\frac{\sqrt{8}}{8}$

$3\sqrt{2}-\frac{2\sqrt{2}}{8}$

$3\sqrt{2}-\frac{\sqrt{2}}{4}$ multiply $3\sqrt{2}\cdot\frac{4}{4}$

$\frac{12\sqrt{2}}{4}-\frac{\sqrt{2}}{4} = \boxed{\frac{11\sqrt{2}}{4}}$

㉔ $2\sqrt{12}-\frac{\sqrt{2}}{\sqrt{3}}$ $\qquad \frac{\sqrt{2}}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{6}}{3}$

$2\sqrt{12}-\frac{\sqrt{6}}{3}$ multiply $2\sqrt{12}\cdot\frac{3}{3}$

$\frac{6\sqrt{12}}{3}-\frac{\sqrt{6}}{3} = \frac{6(2\sqrt{3})}{3}-\frac{\sqrt{6}}{3} = \boxed{4\sqrt{3}-\frac{\sqrt{6}}{3}}$

(25) $\frac{3\sqrt{3}}{6-\sqrt{3}} - \frac{3}{11\sqrt{3}}$

$\frac{3\sqrt{3}}{6-\sqrt{3}} \cdot \frac{6+\sqrt{3}}{6+\sqrt{3}} - \frac{3}{11\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$\frac{18\sqrt{3}+3(3)}{36-3} - \frac{3\sqrt{3}}{11(3)}$

$\frac{18\sqrt{3}+9}{33} - \frac{3\sqrt{3}}{33}$

$\frac{6\sqrt{3}+3}{11} - \frac{\sqrt{3}}{11}$

$\boxed{\frac{5\sqrt{3}+3}{11}}$

(26) $\frac{2\sqrt{6}}{\sqrt{6}-2} - \frac{2\sqrt{2}}{\sqrt{3}}$

$\frac{2\sqrt{6}}{\sqrt{6}-2} \cdot \frac{\sqrt{6}+2}{\sqrt{6}+2} - \frac{2\sqrt{2}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$\frac{2(6)+4\sqrt{6}}{6-4} - \frac{2\sqrt{6}}{3}$

$\frac{12+4\sqrt{6}}{2} - \frac{2\sqrt{6}}{3}$

$6+2\sqrt{6} - \frac{2\sqrt{6}}{3}$

multiply $(6+2\sqrt{6}) \cdot \frac{3}{3}$

$\frac{18+6\sqrt{6}}{3} - \frac{2\sqrt{6}}{3}$

$\boxed{\frac{18+4\sqrt{6}}{3}}$

(27)
$$\begin{array}{r} 23.32 \\ \sqrt{544.0000} \end{array}$$

$$\begin{array}{r|l} 4 & 4 \\ 43 & 144 \\ & 129 \\ 463 & 1500 \\ & 1389 \\ 4662 & 11100 \\ & 9324 \end{array}$$

$\boxed{\approx 23.3}$

(28)
$$\begin{array}{r} 51.05 \\ \sqrt{2607.0000} \end{array}$$

$$\begin{array}{r|l} 25 & 25 \\ 101 & 107 \\ & 101 \\ 1020 & 600 \\ & 0 \\ 10205 & 60000 \\ & 51025 \end{array}$$

$\boxed{\approx 51.1}$

(29) $47 = \sqrt{2209}$, $\sqrt{2229}$ (95), $48 = \sqrt{2304}$ (20)

$47\frac{20}{95} = \boxed{47\frac{4}{19}}$

(30) $40 = \sqrt{1600}$, $\sqrt{1636}$ (81), $41 = \sqrt{1681}$ (36)

$40\frac{36}{81} = \boxed{40\frac{4}{9}}$

(31) $\sqrt{3x+3} = 6$

$3x+3 = 36$

$3x = 33$

$\boxed{x = 11}$

(32) $\sqrt{2n-7} = 7$

$2n-7 = 49$

$2n = 56$

$\boxed{n = 28}$

(33) $\sqrt{2n+7} = n+4$

$2n+7 = (n+4)^2$

$2n+7 = n^2+8n+16$

$0 = n^2+6n+9$

$(n+3)^2 = 0$

$\boxed{n = -3}$

(34) $\sqrt{13-3n} = n-5$

$13-3n = (n-5)^2$

$13-3n = n^2-10n+25$

$0 = n^2-7n+12$

$(n-4)(n-3) = 0$

$n = 4, 3$

neither answer checks

$\boxed{\text{no real solutions}}$

(35) $\sqrt{2x+9} = x+3$

$2x+9 = (x+3)^2$

$2x+9 = x^2+6x+9$

$0 = x^2+4x$

$x(x+4) = 0$

$\boxed{x = 0}$ $\not{-4}$

(36) $\sqrt{2x+6} = x-1$

$2x+6 = (x-1)^2$

$2x+6 = x^2-2x+1$

$0 = x^2-4x-5$

$(x-5)(x+1) = 0$

$\boxed{x = 5}$ $\not{-1}$

(37) $x^2 + (2\sqrt{6})^2 = (4\sqrt{2})^2$

$x^2 + (4)(6) = (16)(2)$

$x^2 = 8 = \boxed{2\sqrt{2}\text{ m}}$

(38) $(3\sqrt{3})^2 + (4\sqrt{3})^2 = x^2$

$(9)(3) + (16)(3) = x^2$

$x^2 = 75$

$x = \sqrt{75} = \boxed{5\sqrt{3}\text{ m}}$

(39) $d = \sqrt{(4-2)^2 + (-9-(-3))^2}$

$d = \sqrt{4+36} = \sqrt{40}$

$d = \boxed{2\sqrt{10}}$

(40) $d = \sqrt{(6-(-2))^2+(-8-(-4))^2}$

$d = \sqrt{64+16} = \sqrt{80}$

$d = \boxed{4\sqrt{5}}$

Unit 10
SKILL CHECK

(1) $\sqrt{28a^3b^5c^6}$

$\boxed{2b^2|ac^3|\sqrt{7ab}}$

(2) $\sqrt{24a^6b^5c^6d^7}$

$\boxed{2b^2|a^3c^3d^3|\sqrt{6bd}}$

(3) $2\sqrt{3}(\sqrt{6}-3\sqrt{3})$

$2\sqrt{18}-6(3)$

$2(3\sqrt{2})-18 = \boxed{6\sqrt{2}-18}$

(4) $3\sqrt{2}-2\sqrt{8}-\sqrt{18}$

$3\sqrt{2}-2(2\sqrt{2})-3\sqrt{2}$

$3\sqrt{2}-4\sqrt{2}-3\sqrt{2} = \boxed{-4\sqrt{2}}$

(5) $\frac{3\sqrt{5}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{3\sqrt{15}}{3} = \boxed{\sqrt{15}}$

(6) $\frac{2\sqrt{6}}{\sqrt{6}+2} \cdot \frac{\sqrt{6}-2}{\sqrt{6}-2}$

$\frac{12-4\sqrt{6}}{6-4} = \frac{12-4\sqrt{6}}{2} = \boxed{6-2\sqrt{6}}$

(7) $\sqrt{40}-\sqrt{\frac{1}{8}}$ $\quad \frac{\sqrt{1}}{\sqrt{8}} \cdot \frac{\sqrt{8}}{\sqrt{8}} = \frac{\sqrt{8}}{8}$

$2\sqrt{10}-\frac{\sqrt{8}}{8}$

$2\sqrt{10}-\frac{2\sqrt{2}}{8} = \boxed{2\sqrt{10}-\frac{\sqrt{2}}{4}}$

(8) $\frac{4\sqrt{5}}{5-\sqrt{5}} - \frac{2\sqrt{15}}{\sqrt{3}}$

$\frac{4\sqrt{5}}{5-\sqrt{5}} \cdot \frac{5+\sqrt{5}}{5+\sqrt{5}} - \frac{2\sqrt{15}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$\frac{20\sqrt{5}+4(5)}{25-5} - \frac{2\sqrt{45}}{3}$

$\frac{20\sqrt{5}+20}{20} - \frac{2(3\sqrt{5})}{3}$

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

(9)

$$\begin{array}{r} 46.35 \\ \sqrt{2149.0000} \\ 86\overline{)549} \quad 16 \\ 926\overline{)3300} \quad 516 \\ 9265\overline{)53100} \quad 2769 \\ 46325 \end{array}$$

$46.35 \approx \boxed{46.4}$

(10) $62 = \sqrt{3844}$, $\sqrt{3894}$, $63 = \sqrt{3969}$ } 125 } 50

$62\frac{50}{125} = \boxed{62\frac{2}{5}}$

(11) $\sqrt{n+5} = n+3$

$n+5 = (n+3)^2$

$n+5 = n^2+6n+9$

$0 = n^2+5n+4$

$(n+1)(n+4) = 0$

$\boxed{n=-1}$ ~~$n=-4$~~

(12) $\sqrt{3x+4} = x+2$

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

$3x+4 = x^2+4x+4$

$0 = x^2+x$

$x(x+1) = 0$

$\boxed{x=0,-1}$

(13) $x^2+(3\sqrt{6})^2 = (6\sqrt{2})^2$

$x^2+54 = 72$

$x^2 = 18 \quad x = \sqrt{18} \quad x = \boxed{3\sqrt{2}\text{ m}}$

(14) $d = \sqrt{(-6-(-12))^2+(7-11)^2}$

$d = \sqrt{36+16} = \sqrt{52} = \boxed{2\sqrt{13}}$

Unit 10
REMEDIATION

① $\sqrt{60x^5y^6z^7}$

$\boxed{2x^2|y^3z^3|\sqrt{15xz}}$

② $\sqrt{27a^3b^5c^{10}d^3}$

$\boxed{3b^2|ac^5d|\sqrt{3abd}}$

③ $3\sqrt{2}(\sqrt{8}+2\sqrt{2})$

$3\sqrt{16}+6(2)$

$3(4)+6(2)=\boxed{24}$

④ $4\sqrt{5}-2\sqrt{20}-3\sqrt{45}$

$4\sqrt{5}-2(2\sqrt{5})-3(3\sqrt{5})$

$4\sqrt{5}-4\sqrt{5}-9\sqrt{5}=\boxed{-9\sqrt{5}}$

⑤ $\frac{2\sqrt{2}}{\sqrt{6}}\cdot\frac{\sqrt{6}}{\sqrt{6}}=\frac{2\sqrt{12}}{6}=\frac{2(2\sqrt{3})}{6}$

$\frac{4\sqrt{3}}{6}=\boxed{\frac{2\sqrt{3}}{3}}$

⑥ $\frac{3\sqrt{3}}{6-\sqrt{3}}\cdot\frac{6+\sqrt{3}}{6+\sqrt{3}}=\frac{18\sqrt{3}+3(3)}{36-3}$

$\frac{18\sqrt{3}+9}{33}=\boxed{\frac{6\sqrt{3}+3}{11}}$

⑦ $\sqrt{54}-\sqrt{\frac{2}{3}}$ $\qquad \frac{\sqrt{2}}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}}=\frac{\sqrt{6}}{3}$

$3\sqrt{6}-\frac{\sqrt{6}}{3}$

$\frac{9\sqrt{6}}{3}-\frac{\sqrt{6}}{3}=\boxed{\frac{8\sqrt{6}}{3}}$

⑧ $\frac{3\sqrt{6}}{\sqrt{6}-3}\cdot\frac{\sqrt{6}+3}{\sqrt{6}+3}-\frac{3\sqrt{2}}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}}$

$\frac{3(6)+9\sqrt{6}}{6-9}-\frac{3\sqrt{6}}{3}$

$\frac{18+9\sqrt{6}}{-3}-\sqrt{6}=(-6-3\sqrt{6})-\sqrt{6}=\boxed{-6-4\sqrt{6}}$

⑨
$$\begin{array}{r} 51.22 \\ \sqrt{2624.0000} \\ 25 \\ 101\overline{)124} \\ 101 \\ 1022\overline{)2300} \\ 2044 \\ 10242\overline{)25600} \\ 20484 \end{array}$$

$51.22 \approx \boxed{51.2}$

⑩ $60=\sqrt{3600}$ } 121 } 44

$\sqrt{3644}$

$61=\sqrt{3721}$

$60\frac{44}{121}=\boxed{60\frac{4}{11}}$

⑪ $\sqrt{10+x}=x+4$

$10+x=(x+4)^2$

$10+x=x^2+8x+16$

$0=x^2+7x+6$

$(x+1)(x+6)=0$

$\boxed{x=-1}$ $\quad -6$

⑫ $\sqrt{2n+4}=n-2$

$2n+4=(n-2)^2$

$2n+4=n^2-4n+4$

$0=n^2-6n$

$n=n(n-6)$

$\boxed{n=6}$

⑬ $x^2+(1+\sqrt{3})^2=(2\sqrt{30})^2$

$x^2+(16)(3)=(4)(30)$

$x^2+48=120$

$x^2=72 \qquad x=\sqrt{72} \qquad x=\boxed{6\sqrt{2}m}$

⑭ $d=\sqrt{(4-(-4))^2+(-11-(-7))^2}$

$d=\sqrt{(8)^2+(-4)^2}=\sqrt{64+16}$

$d=\sqrt{80}$

$d=\boxed{4\sqrt{5}}$

Unit 10

EXTRA PRACTICE

① $\pm\sqrt{288} = \pm\sqrt{2^5 \cdot 3^2} = \boxed{\pm 12\sqrt{2}}$

② $\sqrt{27x^5} = \boxed{3x^2\sqrt{3x}}$

③ $\sqrt{24a^3b^2} = \boxed{2a|b|\sqrt{6a}}$

④ $\sqrt{45x^3y^2z^5} = \boxed{3|x|y|z^2\sqrt{5xz}}$

⑤ $(4\sqrt{12})(3\sqrt{2}) = 12\sqrt{24} = \boxed{24\sqrt{6}}$

⑥ $\sqrt{6}(2\sqrt{6}-\sqrt{3}) = 2(6)-\sqrt{18} = \boxed{12-3\sqrt{2}}$

⑦ $2\sqrt{18}-3\sqrt{8}+\sqrt{32}$
$2(3\sqrt{2})-3(2\sqrt{2})+4\sqrt{2} = \boxed{4\sqrt{2}}$

⑧ $3\sqrt{3}-2\sqrt{75} = 3\sqrt{3}-2(5\sqrt{3}) = \boxed{-7\sqrt{3}}$

⑨ $\frac{3\sqrt{2}}{\sqrt{10}} \cdot \frac{\sqrt{10}}{\sqrt{10}} = \frac{3\sqrt{20}}{10} = \frac{6\sqrt{5}}{10} = \boxed{\frac{3\sqrt{5}}{5}}$

⑩ $\frac{2\sqrt{3}}{\sqrt{3}-3} \cdot \frac{\sqrt{3}+3}{\sqrt{3}+3} = \frac{6+6\sqrt{3}}{3-9} = \boxed{-1-\sqrt{3}}$

⑪ $\sqrt{45}-\sqrt{\frac{1}{5}} = 3\sqrt{5}-\frac{\sqrt{5}}{5} = \frac{15\sqrt{5}}{5}-\frac{\sqrt{5}}{5}$

$\boxed{\frac{14\sqrt{5}}{5}}$

⑫

$$\begin{array}{r} 21.16 \approx \boxed{21.2} \\ \sqrt{448.00\,00} \\ 4 \\ \hline 41 \;|\; 048 \\ 41 \\ \hline 421 \;|\; 700 \\ 421 \\ \hline 4226 \;|\; 27900 \\ 25356 \end{array}$$

⑬ $49 = \sqrt{2401}$
$\sqrt{2467}$ } 99 } 66
$50 = \sqrt{2500}$

$\boxed{49\frac{2}{3}}$

⑭ $\sqrt{3n-9} = 3$
$3n-9 = 9$
$3n = 18$
$\boxed{n=6}$

⑮ $\sqrt{n+5} = n+5$
$n+5 = n^2+10n+25$
$n^2+9n+20 = 0$
$(n+5)(n+4) = 0$
$\boxed{-5, -4}$

⑯ $\sqrt{n-2} = n-4$
$n-2 = n^2-8n+16$
$n^2-9n+18 = 0$
$(n-6)(n-3) = 0$
$\boxed{6}$ ~~3~~

⑰ $x^2+(2\sqrt{2})^2 = (2\sqrt{10})^2$
$x^2+(4)(2) = (4)(10)$
$x^2+8 = 40$
$x^2 = 32 = 2\sqrt{2}$ $\boxed{2\sqrt{2}\text{ m}}$

⑱ $d = \sqrt{(2-4)^2+(-8-(-12))^2}$
$d = \sqrt{(-2)^2+(4)^2} = \sqrt{20} = \boxed{2\sqrt{5}}$

⑲ $\sqrt{72a^4b^3c^5d^6} = \boxed{6a^2c^2|bd^3|\sqrt{2c}}$

c is independent because of odd exponent. c^2 is protected in solution because of even exponent.

a, b, and d all have odd exponents in radicand. Either 0 or 2 of them are negative. b and d^3 must be protected. a^2 is protected (even exp).

⑳ $\frac{2\sqrt{3}}{\sqrt{3}-3}+\sqrt{3}$

$\frac{2\sqrt{3}}{\sqrt{3}-3}\left(\frac{\sqrt{3}+3}{\sqrt{3}+3}\right)+\sqrt{3}$

$\frac{6+6\sqrt{3}}{3-9}+\sqrt{3} = -6-\sqrt{3}+\sqrt{3} = \boxed{-6}$

11.1
Answer Key

① upward
② upward
③ downward
④ upward
⑤ downward
⑥ downward

⑦ $y=x^2-4x+3$
axis $x=\frac{-b}{2a}=\frac{4}{2}$
$(2)^2-4(2)+3=-1$

x=2
minimum
(2,-1)

⑧ $y=-3x^2-6x+5$
axis $x=\frac{-b}{2a}=\frac{6}{-6}$
$-3(-1)^2-6(-1)+5=8$

x=-1
maximum
(-1,8)

⑨ $y=7x^2+14x-9$
axis $x=\frac{-b}{2a}=\frac{-14}{14}$
$7(-1)^2+14(-1)-9=-16$

x=-1
minimum
(-1,-16)

⑩ $y=x^2+6x+8$
axis $x=\frac{-b}{2a}=\frac{-6}{2}$
$(-3)^2+6(-3)+8=-1$

x=-3
minimum
(-3,-1)

⑪ $y=x^2+8x+3$
axis $x=\frac{-b}{2a}=\frac{-8}{2}$
$(-4)^2+8(-4)+3=-13$

x=-4
minimum
(-4,-13)

⑫ $y=x^2+2x$
axis $x=\frac{-b}{2a}=\frac{-2}{2}$
$(-1)^2+2(-1)=-1$

x=-1
minimum
(-1,-1)

⑬ $y=-3x^2+4$
axis $x=\frac{-b}{2a}=\frac{0}{-6}$
$-3(0)^2+4=4$

x=0
maximum
(0,4)

⑭ $y=-2x^2-9$
axis $x=\frac{-b}{2a}=\frac{0}{-4}$
$-2(0)^2-9=-9$

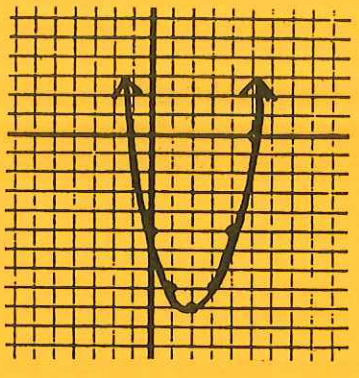
x=0
maximum
(0,-9)

⑮ $y=x^2-4x-5$

x=2
(2,-9)

$(2)^2-4(2)-5=-9$

x	y
1	-8
0	-5
-1	0

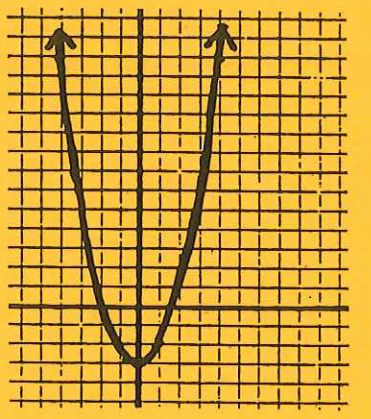


⑯ $y=x^2-3$

x=0
(0,-3)

$(0)^2-3=-3$

x	y
1	-2
3	6
4	13

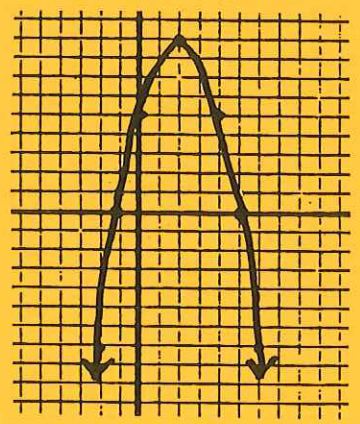


⑰ $y=-x^2+4x+5$

x=2
(2,9)

$-(2)^2+4(2)+5=9$

x	y
0	5
-1	0
-2	-7

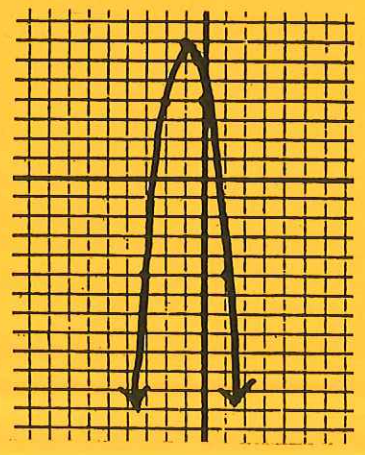


⑱ $y=-3x^2-6x+4$

x=-1
(-1,7)

$-3(-1)^2-6(-1)+4=7$

x	y
0	4
1	-5
2	-20

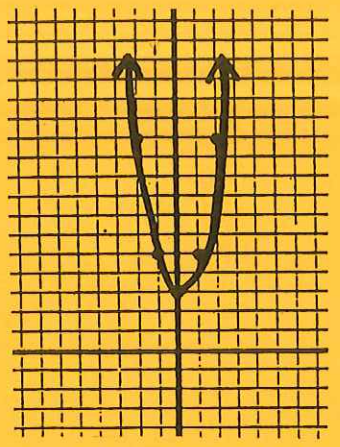


⑲ $y=2x^2+3$

$x=0$
$(0,3)$

$2(0)+3=3$

x	y
1	5
2	11
3	21

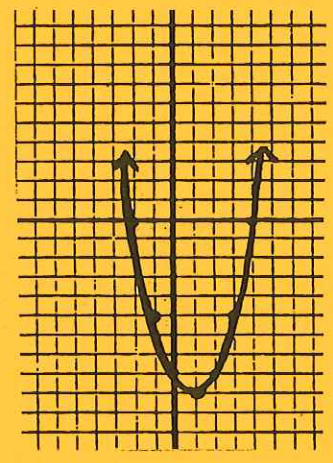


⑳ $y=x^2-2x-8$

$x=1$
$(1,-9)$

$(1)^2-2(1)-8=-9$

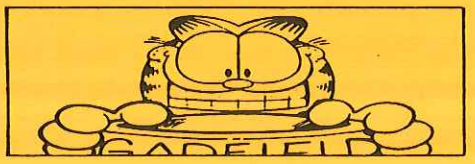
x	y
0	-8
-1	-5
-2	0



11.2
Answer Key

① equation
② Function
③ Function
④ equation
⑤ equation
⑥ function

⑦ (-7,0) (-1,0)
⑧ (0,0) (6,0)
⑨ (-4,0)
⑩ none

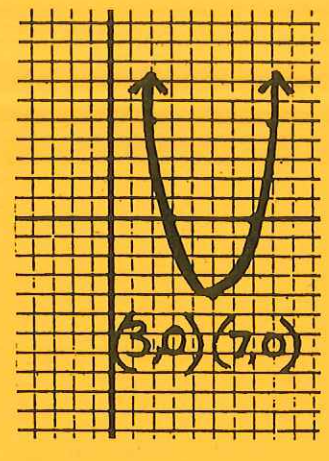


⑪ $y=x^2-10x+21$

$x=5$
$(5,-4)$

$(5)^2-10x+21=-4$

x	y
4	-3
3	0
2	5

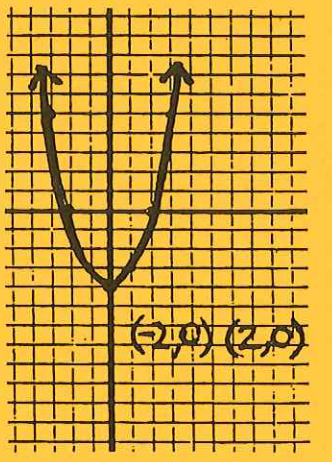


⑫ $y=x^2-4$

$x=0$
$(0,-4)$

$(0)^2-4=-4$

x	y
1	-3
2	0
3	5

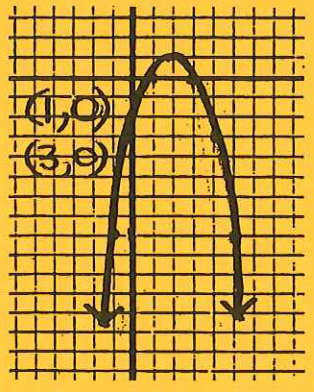


⑬ $y=-x^2+4x-3$

$x=2$
$(2,1)$

$-(2)^2+4(2)-3=1$

x	y
1	0
0	-3
-1	-8

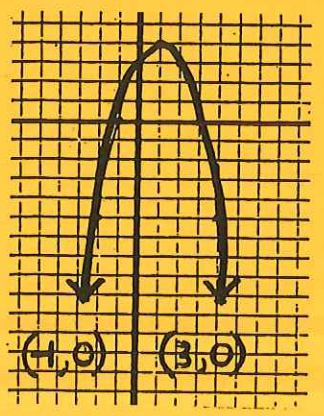


⑭ $y=-x^2+2x+3$

$x=1$
$(1,4)$

$-(1)^2+2(1)+3=4$

x	y
0	3
-1	0
-2	-5



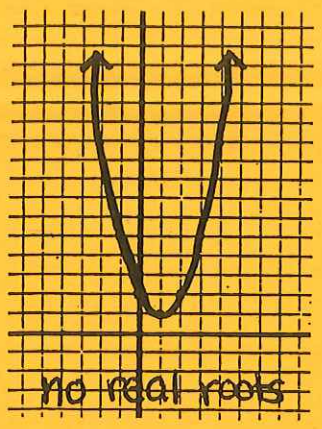
⑮ $y=x^2-2x+2$

$x=1$

$(1,1)$

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

x	y
0	2
-1	5
-2	10



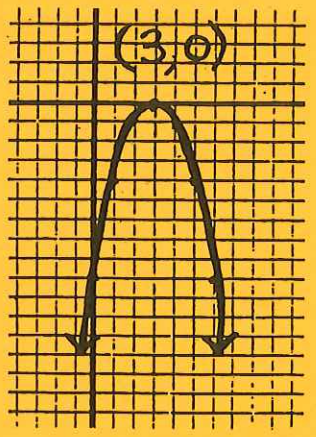
⑯ $y=-x^2+6x-9$

$x=3$

$(3,0)$

$-(3)^2+6(3)-9=0$

x	y
2	-1
1	-4
0	-9



11.3
Answer Key

① $y^2+4y+3=0$

$y^2+4y=-3$

$+2$ $y^2+4y+4=-3+4$

$(y+2)^2=1$

$y+2=\pm\sqrt{1}$

$y=-2\pm1$

$\boxed{y=-3,-1}$

② $n^2+8n+7=0$

$n^2+8n=-7$

$+4$ $n^2+8n+16=-7+16$

$(n+4)^2=9$

$n+4=\pm\sqrt{9}$

$n=-4\pm3$

$\boxed{n=-1,-7}$

③ $x^2-4x=2$

-2 $x^2-4x+4=2+4$

$(x-2)^2=6$

$x-2=\pm\sqrt{6}$

$\boxed{x=2\pm\sqrt{6}}$

④ $y^2-8y=4$

-4 $y^2-8y+16=4+16$

$(y-4)^2=20$

$y-4=\pm\sqrt{20}$

$\boxed{y=4\pm2\sqrt{5}}$

⑤ $\frac{1}{2}a^2-2a-\frac{3}{2}=0$ $\times(2)$

$a^2-4a-3=0$

$a^2-4a=3$

-2 $a^2-4a+4=3+4$

$(a-2)^2=7$

$a-2=\pm\sqrt{7}$

$\boxed{a=2\pm\sqrt{7}}$

⑥ $2x^2-16x=24$ $\div(2)$

$x^2-8x=12$

-4 $x^2-8x+16=12+16$

$(x-4)^2=28$

$x-4=\pm\sqrt{28}$

$x-4=\pm2\sqrt{7}$

$\boxed{x=4\pm2\sqrt{7}}$

⑦ $3x^2-18x+21=0$ $\div(3)$

$x^2-6x+7=0$

$x^2-6x=-7$

-3 $x^2-6x+9=-7+9$

$(x-3)^2=2$

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

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

⑧ $\frac{1}{4}b^2-\frac{3}{2}b=-1$ $\times(4)$

$b^2-6b=-4$

$b^2-6b+9=-4+9$

-3 $(b-3)^2=5$

$b-3=\pm\sqrt{5}$

$\boxed{b=3\pm\sqrt{5}}$

⑨ $x^2+4x+c=0$

$x^2+4x=-c$

$+2$ $x^2+4x+4=-c+4$

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

$x+2=\pm\sqrt{4-c}$

$\boxed{x=-2\pm\sqrt{4-c}}$

11.4
Answer Key

① $m^2+4m+3=0$

$a=1 \quad b=4 \quad c=3$

$m=\frac{-4\pm\sqrt{(4)^2-4(1)(3)}}{2(1)}$

$m=\frac{-4\pm\sqrt{4}}{2}=\frac{-4\pm2}{2}$

$\boxed{m=-1,-3}$

② $2x^2+x-15=0$

$a=2 \quad b=1 \quad c=-15$

$x=\frac{-1\pm\sqrt{(1)^2-4(2)(-15)}}{2(2)}$

$x=\frac{-1\pm\sqrt{121}}{4}=\frac{-1\pm11}{4}$

$\boxed{x=\frac{5}{2},-3}$

③ $y^2-25=0$

$a=1 \quad b=0 \quad c=-25$

$y=\frac{-0\pm\sqrt{(0)^2-4(1)(-25)}}{2(1)}$

$y=\pm\frac{\sqrt{100}}{2}=\frac{\pm10}{2}$ $\boxed{y=\pm5}$

④ $5a^2=125$

$5a^2-125=0$

$a=5 \quad b=0 \quad c=-125$

$a=\frac{-0\pm\sqrt{(0)^2-4(5)(-125)}}{2(5)}$

$a=\pm\frac{\sqrt{2500}}{10}=\frac{\pm50}{10}$

$\boxed{a=\pm5}$

⑩ $x^2-bx+8=0$

$x^2-bx=-8$

$-\frac{b}{2}$ $x^2-bx+\frac{b^2}{4}=-8+\frac{b^2}{4}$

$(x-\frac{b}{2})^2=\frac{b^2-32}{4}$

$x-\frac{b}{2}=\frac{\pm\sqrt{b^2-32}}{2}$

$\boxed{x=\frac{b\pm\sqrt{b^2-32}}{2}}$

⑪ upward

⑫ downward

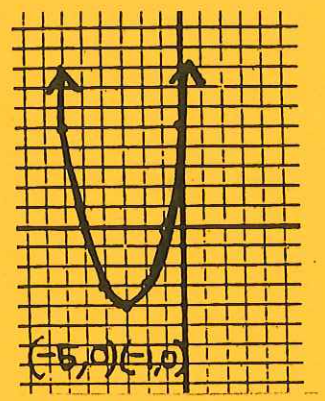
⑬ $y=x^2+6x+5$

$\boxed{x=-3}$

$\boxed{(-3,-4)}$

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

x	y
-2	-3
-1	0
0	5



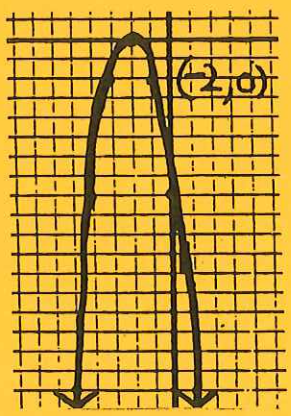
⑭ $y=-2x^2-8x-8$

$\boxed{x=-2}$

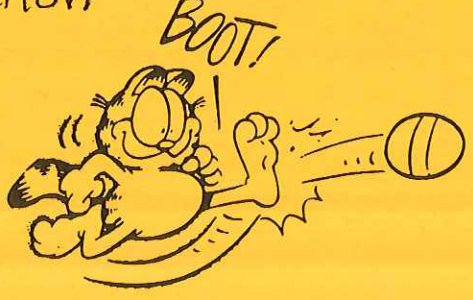
$\boxed{(-2,0)}$

$-2(-2)^2-8(-2)-8=0$

x	y
-1	-2
0	-8
1	-18



⑮ quadratic function



⑤ $-n^2-6n+3=0$

$a=-1 \quad b=-6 \quad c=3$

$n=\frac{-(-6)\pm\sqrt{(-6)^2-4(-1)(3)}}{2(-1)}$

$n=\frac{6\pm\sqrt{48}}{-2}=\frac{6\pm4\sqrt{3}}{-2}$

$\boxed{n=-3\pm2\sqrt{3}}$

⑥ $k^2-6k+1=0$

$a=1 \quad b=-6 \quad c=1$

$k=\frac{-(-6)\pm\sqrt{(-6)^2-4(1)(1)}}{2(1)}$

$k=\frac{6\pm\sqrt{32}}{2}=\frac{6\pm4\sqrt{2}}{2}$

$\boxed{k=3\pm2\sqrt{2}}$

⑦ $4x^2+8x-1=0$

$a=4 \quad b=8 \quad c=-1$

$x=\frac{-8\pm\sqrt{(8)^2-4(4)(-1)}}{2(4)}$

$x=\frac{-8\pm\sqrt{80}}{8}=\frac{-8\pm4\sqrt{5}}{8}$

$\boxed{x=-1\pm\frac{1}{2}\sqrt{5}}$ or $\boxed{x=\frac{-2\pm\sqrt{5}}{2}}$

⑧ $-4y^2+16y+13=0$

$a=-4 \quad b=16 \quad c=13$

$y=\frac{-16\pm\sqrt{(16)^2-4(-4)(13)}}{2(-4)}$

$y=\frac{-16\pm\sqrt{464}}{-8}=\frac{-16\pm4\sqrt{29}}{-8}$

$\boxed{y=2\pm\frac{1}{2}\sqrt{29}}$ or $\boxed{y=\frac{4\pm\sqrt{29}}{2}}$

⑨ $-2x^2+8x+3=3$

$-2x^2+8x=0 \quad \div(-2)$

$x^2-4x=0$

continued in next column

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

$(x-2)^2=4$

$x-2=\pm\sqrt{4}$

$x=2\pm2$ $\boxed{x=0,4}$

⑩ $4n^2+20n+23=0$

$4n^2+20n=-23 \quad \div(4)$

$n^2+5n=\frac{-23}{4}$

$\frac{5}{2}$ $n^2+5n+\frac{25}{4}=\frac{-23}{4}+\frac{25}{4}$

$(n+5/2)^2=\frac{1}{2}$

$n+5/2=\pm\sqrt{\frac{1}{2}}$ $\quad \frac{\sqrt{1}}{\sqrt{2}}\cdot\frac{\sqrt{2}}{\sqrt{2}}=\frac{\sqrt{2}}{2}$

$n+5/2=\pm\frac{\sqrt{2}}{2}$

$\boxed{n=\frac{-5\pm\sqrt{2}}{2}}$

⑪ $ax^2+2ax+ab=0$

$ax^2+2ax=-ab \quad \div(a)$

$x^2+2x=-b$

1 $x^2+2x+1=-b+1$

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

$x+1=\pm\sqrt{1-b}$ $\boxed{x=-1\pm\sqrt{1-b}}$

⑫ $ax^2+bx+3a=0$

$ax^2+bx=-3a \quad \div(a)$

$x^2+\frac{b}{a}x=-3$

$\frac{b}{2a}$ $x^2+\frac{b}{a}x+\frac{b^2}{4a^2}=-3+\frac{b^2}{4a^2}$

$\left(x+\frac{b}{2a}\right)^2=\frac{b^2-12a^2}{4a^2}$

$x+\frac{b}{2a}=\pm\frac{\sqrt{b^2-12a^2}}{2a}$ $\boxed{x=\frac{-b\pm\sqrt{b^2-12a^2}}{2a}}$

⑬ $3x^2+12ax+3b=0$

$3x^2+12ax=-3b \quad \div(3)$

$x^2+4ax=-b$

$2a$ $x^2+4ax+4a^2=-b+4a^2$

$(x+2a)^2=4a^2-b$

$x+2a=\pm\sqrt{4a^2-b}$

$\boxed{x=-2a\pm\sqrt{4a^2-b}}$

11.5
Answer Key

① $z^2+8z-5=0$
$a=1 \quad b=8 \quad c=-5$
b^2-4ac
$(8)^2-4(1)(-5)=84$
Irrational
2 real roots

② $m^2+7m+6=0$
$a=1 \quad b=7 \quad c=6$
b^2-4ac
$(7)^2-4(1)(6)=25$
Rational
2 real roots

③ $k^2+6k+10=0$
$a=1 \quad b=6 \quad c=10$
b^2-4ac
$(6)^2-4(1)(10)=-4$
Imaginary
no real roots

④ $m^2-14m+49=0$
$a=1 \quad b=-14 \quad c=49$
b^2-4ac
$(-14)^2-4(1)(49)=0$
Rational
1 real root

⑤ $3g^2-4g+1=0$
$a=3 \quad b=-4 \quad c=1$
b^2-4ac
$(-4)^2-(4)(3)(1)=4$
Rational
2 real roots

⑥ $d^2+4d+7=0$
$a=1 \quad b=4 \quad c=7$
b^2-4ac
$(4)^2-4(1)(7)=-12$
Imaginary
no real roots

⑦ $9y^2-6y+1=0$
$a=9 \quad b=-6 \quad c=1$
b^2-4ac
$(-6)^2-4(9)(1)=0$
Rational
1 real root

⑧ $3p^2-4p-1=0$
$a=3 \quad b=-4 \quad c=-1$
b^2-4ac
$(-4)^2-4(3)(-1)$
Irrational
2 real roots

⑨ $2b^2-b-14=7$
$2b^2-b=21 \quad \div 2$
$b^2-\frac{1}{2}b=21/2$
$\frac{1}{16}$ $b^2-\frac{1}{2}b+\frac{1}{16}=\frac{21}{2}+\frac{1}{16}$
$(b-1/4)^2=\frac{169}{16}$
$b-1/4=\pm\frac{13}{4}$
$b=\frac{1\pm13}{4}$ $\quad b=\frac{7}{2},-3$

⑩ $2ax^2+2abx+6ac=0$
$2ax^2+2abx=-6ac$
divide by $2a$
$x^2+bx=-3c$
$\frac{b}{2}$ $x^2+bx+\frac{b^2}{4}=-3c+\frac{b^2}{4}$
$(x+\frac{b}{2})^2=\frac{b^2-12c}{4}$
$x+\frac{b}{2}=\pm\frac{\sqrt{b^2-12c}}{2}$

$$x=\frac{-b\pm\sqrt{b^2-12c}}{2}$$

11.6
Answer Key

① $x^2-8x+15=0$
$(x-5)(x-3)=0$
$\boxed{x=5,3}$

② $n^2-5n-24=0$
$(n-8)(n+3)=0$
$\boxed{n=8,-3}$

③ $2n^2=7n-4=0$
$2n^2-8n+n-4=0$
$2n(n-4)+1(n-4)=0$
$(n-4)(2n+1)=0$
$\boxed{n=4,-\frac{1}{2}}$

④ $6x^2+x-2=0$
$6x^2+4x-3x-2=0$
$2x(3x+2)-1(3x+2)=0$
$(3x+2)(2x-1)=0$
$\boxed{x=-\frac{2}{3},\frac{1}{2}}$

⑤ $x(13-x)=42$
$13x-x^2=42$
$x^2-13x+42=0$
$(x-6)(x-7)=0$
$\boxed{x=6,7}$

⑥ $x(17-x)=72$
$17x-x^2=72$
$x^2-17x+72=0$
$(x-9)(x-8)=0$
$\boxed{x=9,8}$

⑦ $x(x+6)=135$
$x^2+6x-135=0$
$(x+15)(x-9)=0$
$x=-15,9$

x	-15	9
$x+6$	-9	15

⑧ $x(x+8)=48$
$x^2+8x-48=0$
$(x+12)(x-4)=0$
$x=-12,4$

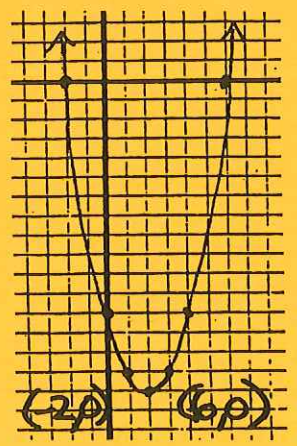
x	-12	4
$x+8$	-4	12

⑪ $3k^2+11k=4$
$3k^2+11k-4=0$
$a=3 \quad b=11 \quad c=-4$
$k=\frac{-11\pm\sqrt{(11)^2-4(3)(-4)}}{2(3)}$
$k=\frac{-11\pm\sqrt{169}}{6}=\frac{-11\pm13}{6}$
$\boxed{k=\frac{1}{3},-4}$

⑫ $ax^2+3bx+c=0$
$a=a \quad b=3b \quad c=c$
$x=\frac{-3b\pm\sqrt{(3b)^2-4(a)(c)}}{2(a)}$
$\boxed{x=\frac{-3b\pm\sqrt{9b^2-4ac}}{2a}}$

⑬ $y=x^2-4x-12$
$\boxed{x=2}$
$\boxed{(2,-16)}$
$(2)^2-4(2)-12=-16$

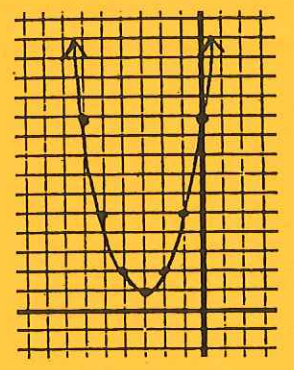
x	y
1	-15
0	-12
-2	0



⑭ $y=x^2+6x+10$
$\boxed{x=-3}$
$\boxed{(-3,1)}$
$(-3)^2+6(-3)+10=1$

x	y
-2	2
-1	5
0	10

no real roots



⑨ $x(x+4)=45$

$x^2+4x=45$

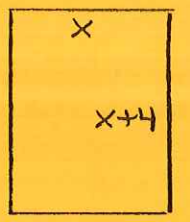
2 $x^2+4x+4=45+4$

$(x+2)^2=49$

$x+2=\pm\sqrt{49}$

$x+2=\pm 7$

$x=-2\pm 7=5,-9$



5 by 9 in

⑩ $x(x-3)=54$

$x^2-3x=54$

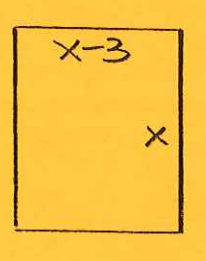
$\frac{9}{4}$ $x^2-3x+\frac{9}{4}=54+\frac{9}{4}$

$(x-3/2)^2=\frac{225}{4}$

$x-3/2=\pm\sqrt{\frac{225}{4}}$

$x-3/2=\pm\frac{15}{2}$

$x=\frac{3\pm 15}{2}=9,-6$



9 by 6 feet

⑪ $x(3x-1)=24$

$3x^2-x=24$

$x^2-\frac{1}{3}x=8$

$\frac{1}{36}$ $x^2-\frac{1}{3}x+\frac{1}{36}=8+\frac{1}{36}$

$(x-\frac{1}{6})^2=\frac{289}{36}$

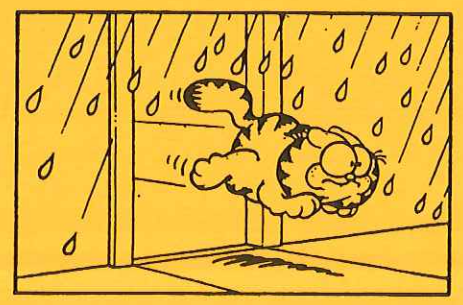
$x-\frac{1}{6}=\pm\sqrt{\frac{289}{36}}$

$x-\frac{1}{6}=\pm\frac{17}{6}$

$x=\frac{1\pm 17}{6}$

$x=3,-\frac{8}{3}$

3 by 8 inches



⑫ $x(2x-3)=35$

$2x^2-3x=35$

$x^2-\frac{3}{2}x=\frac{35}{2}$

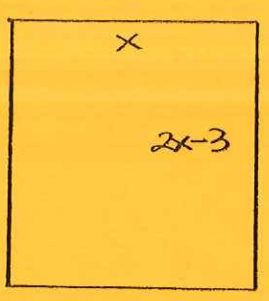
$\frac{9}{16}$ $x^2-\frac{3}{2}x+\frac{9}{16}=\frac{35}{2}+\frac{9}{16}$

$(x-\frac{3}{4})^2=\frac{289}{16}$

$x-\frac{3}{4}=\pm\sqrt{\frac{289}{16}}$

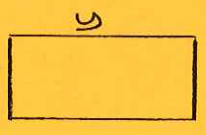
$x-\frac{3}{4}=\pm\frac{17}{4}$

$x=\frac{3\pm 17}{4}=5,-\frac{7}{2}$



5 by 7 in

⑬



$2x+2y=36$

$x+y=18$

$y=18-x$

$xy=72$

$x(18-x)=72$

$18x-x^2=72$

$x^2-18x+72=0$

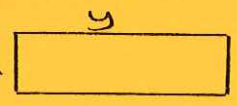
$a=1\quad b=-18\quad c=72$

$x=\frac{-(-18)\pm\sqrt{(-18)^2-4(1)(72)}}{2(1)}$

$x=\frac{18\pm\sqrt{36}}{2}=\frac{18\pm 6}{2}=12,6$

6 by 12 cm

⑭



$2x+2y=26$

$x+y=13$

$y=13-x$

$xy=36$

$x(13-x)=36$

$13x-x^2=36$

$x^2-13x+36=0$

$a=1\quad b=-13\quad c=36$

$x=\frac{-(-13)\pm\sqrt{(-13)^2-4(1)(36)}}{2(1)}$

$x=\frac{13\pm\sqrt{25}}{2}=\frac{13\pm 5}{2}=9,4$

4 by 9 in.

⑮ $(2x+20)(2x+15)-(15)(20)=74$

$(4x^2+70x+300)-(300)=74$

$4x^2+70x-74=0$

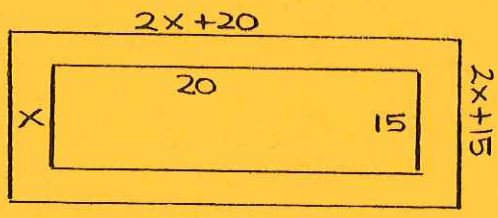
$2x^2+35x-37=0$

$a=2 \quad b=35 \quad c=-37$

$x=\frac{-(35)\pm\sqrt{(35)^2-4(2)(-37)}}{2(2)}$

$x=\frac{-35\pm\sqrt{1521}}{4}=\frac{-35\pm39}{4}$

$x=1, \cancel{-37/2}$ **1 yard**



⑯ $(2x+5)^2-(5)^2=56$

$(4x^2+20x+25)-25=56$

$4x^2+20x-56=0$

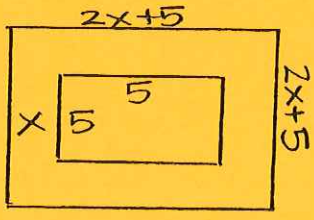
$x^2+5x-14=0$

$a=1 \quad b=5 \quad c=-14$

$x=\frac{-5\pm\sqrt{5^2-4(1)(-14)}}{2(1)}$

$x=\frac{-5\pm\sqrt{81}}{2}=\frac{-5\pm9}{2}$

$x=2, \cancel{-7}$ **2 feet**



⑰ $ax^2+c=-bx$

$ax^2+bx=-c$

$x^2+\frac{b}{a}x=\frac{-c}{a}$

$\frac{b}{2a}$ $x^2+\frac{b}{a}x+\frac{b^2}{4a^2}=\frac{-c}{a}+\frac{b^2}{4a^2}$

continued (next column)

$\left(x+\frac{b}{2a}\right)^2=\frac{b^2-4ac}{4a^2}$

$x+\frac{b}{2a}=\frac{\pm\sqrt{b^2-4ac}}{2a}$

$$\boxed{x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}}$$

11.7
Answer Key

① $a^2-5a-24=0$ **sum 5 prod −24**

② $b^2+12b-28=0$ **sum −12 prod −28**

③ $4y^2+4y+1=0$

$y^2+y+\frac{1}{4}=0$ **sum −1 prod 1/4**

④ $3n^2+11n-20=0$

$n^2+\frac{11}{3}n-\frac{20}{3}=0$ **sum $-\frac{11}{3}$ prod $-\frac{20}{3}$**

⑤ $a^2+4a\sqrt{3}+9=0$ **sum $-4\sqrt{3}$, prod 9**

⑥ $2y^2+y\sqrt{2}-6=0$

$y^2+\frac{1}{2}\sqrt{2}-3=0$ **sum $-\frac{1}{2}\sqrt{2}$ prod −3**

⑦ roots: 4, 7

$x^2-11x+28=0$

⑧ roots: 5, −9

$x^2+4x-45=0$

⑨ roots: $5/2, 2$

$x^2-\frac{9}{2}x+5=0$

$2x^2-9x+10=0$

⑩ roots $2/3, -3/2$

$x^2+5/6x-1=0$

$6x^2+5x-6=0$

⑪ roots: $-4/5, 5/4$

$x^2 - \frac{9}{20}x - 1 = 0$

$\boxed{20x^2 - 9x - 20 = 0}$

⑫ roots: $-3/4, 8$

$x^2 - \frac{29}{4}x - 6 = 0$

$\boxed{4x^2 - 29x - 24 = 0}$

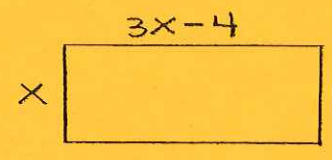
⑬ roots: $\sqrt{3}, \sqrt{3}$

$\boxed{x^2 - 2x\sqrt{3} + 3 = 0}$

⑭ roots: $2+\sqrt{3}, 2-\sqrt{3}$

$\boxed{x^2 - 4x + 1 = 0}$

⑮



$x(3x-4) = 32$

$3x^2 - 4x = 32$

$x^2 - \frac{4}{3}x = \frac{32}{3}$

$\frac{2}{3}$ $x^2 - \frac{4}{3}x + \frac{4}{9} = \frac{32}{3} + \frac{4}{9}$

$\left(x - \frac{2}{3}\right)^2 = \frac{100}{9}$

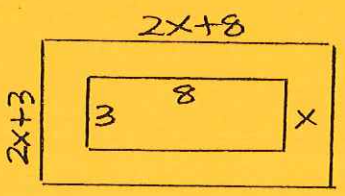
$x - \frac{2}{3} = \pm\sqrt{\frac{100}{9}}$

$x - \frac{2}{3} = \pm\frac{10}{3}$

$x = \frac{2 \pm 10}{3} = 4, \cancel{-8/3}$

$\boxed{4 \text{ by } 8 \text{ cm}}$

⑯



$(2x+8)(2x+3) - (8)(3) = 60$

$(4x^2 + 22x + 24) - (24) = 60$

continued

$4x^2 + 22x - 60 = 0$

$2x^2 + 11x - 30 = 0$

$a = 2 \quad b = 11 \quad c = -30$

$x = \frac{-11 \pm \sqrt{(11)^2 - 4(2)(-30)}}{2(2)}$

$x = \frac{-11 \pm \sqrt{361}}{4}$

$x = \frac{-11 \pm 19}{4} = 2, \cancel{-15/4}$

$\boxed{2 \text{ inches}}$

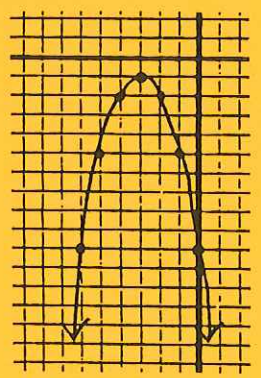
⑰ $y = -x^2 - 6x - 10$

$x = -3$

$(-3, -1)$

$-(-3)^2 - 6(-3) - 10 = -1$

x	y
-2	-2
-1	-5
0	-10



Unit 11
REVIEW
Answer Key

① downward
② upward
③ equation
④ function

⑤ $y = x^2 - 8x + 12$

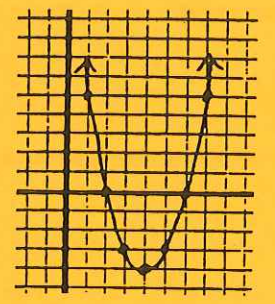
$\boxed{x = 4}$

$y = (4)^2 - 8(4) + 12$

$y = -4$

$\boxed{(4, -4)}$

x	y
3	-3
2	0
1	5



$\boxed{(2,0)\ (6,0)}$

⑥ $y = -x^2 - 6x - 9$

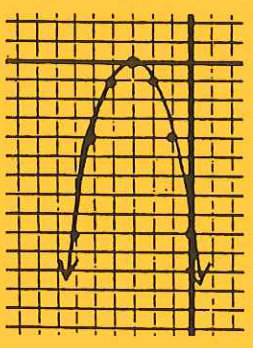
$\boxed{x = -3}$

$y = -(-3)^2 - 6(-3) - 9$

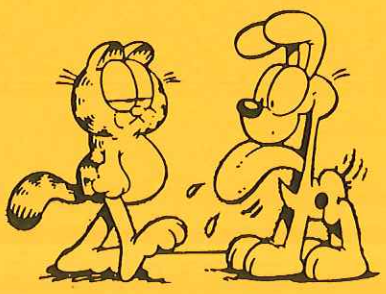
$y = 0$

$\boxed{(-3, 0)}$

x	y
-2	-1
-1	-4
0	-9



$\boxed{(-3, 0)}$



⑦ $y=-x^2-2x+8$

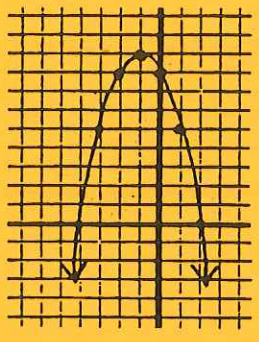
$\boxed{x=-1}$

$y=-(-1)^2-2(-1)+8$

$y=9$

$\boxed{(-1,9)}$

x	y
0	8
1	5
2	0



$\boxed{(-4,0)(2,0)}$

⑧ $y=x^2-8x+15$

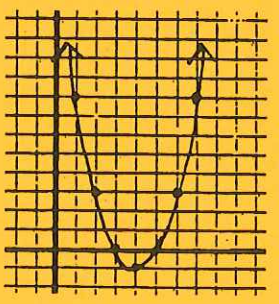
$\boxed{x=4}$

$y=(4)^2-8(4)+15$

$y=-1$

$\boxed{(4,-1)}$

x	y
3	0
2	3
1	8



$\boxed{(3,0)\ (5,0)}$

⑨ $x^2-x-12=0$

$(x-4)(x+3)=0$

$\boxed{x=4,-3}$

⑩ $x^2-7x+12=0$

$(x-4)(x-3)=0$

$\boxed{x=4,3}$

⑪ $2x^2-5x-3=0$

$2x^2-6x+x-3=0$

$2x(x-3)+1(x-3)=0$

$(x-3)(2x+1)=0$

$\boxed{x=3,-1/2}$

⑫ $3x^2+13x+4=0$

$3x^2+12x+x+4=0$

$3x(x+4)+1(x+4)=0$

$(x+4)(3x+1)=0$

$\boxed{x=-4,-1/3}$

⑬ $x^2-16x+32=0$

$x^2-16x=-32$

-8 $x^2-16x+64=-32+64$

$(x-8)^2=32$

$x-8=\pm\sqrt{32}$

$x=8\pm\sqrt{32}$

$\boxed{x=8\pm4\sqrt{2}}$

⑭ $x^2+6x+4=0$

$x^2+6x=-4$

$+3$ $x^2+6x+9=-4+9$

$(x+3)^2=5$

$x+3=\pm\sqrt{5}$

$\boxed{x=-3\pm\sqrt{5}}$

⑮ $2x^2+3=7x$

$2x^2-7x=-3$

$x^2-\frac{7}{2}x=-\frac{3}{2}$

$-\frac{7}{4}$ $x^2-\frac{7}{2}x+\frac{49}{16}=-\frac{3}{2}+\frac{49}{16}$

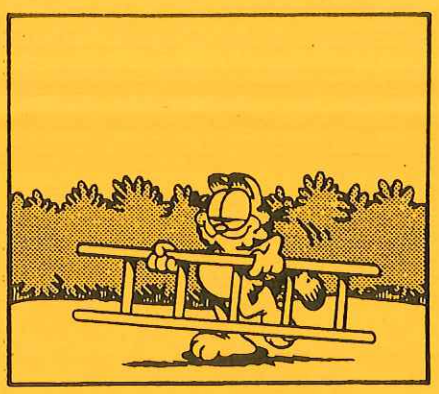
$(x-\frac{7}{4})^2=\frac{25}{16}$

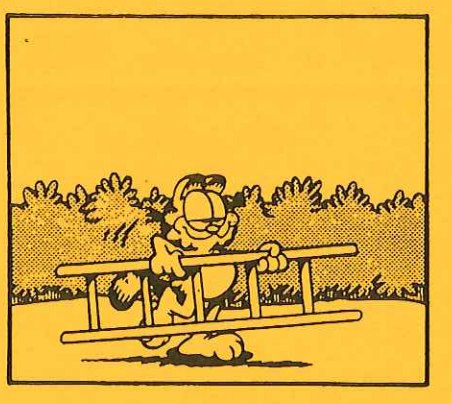
$x-\frac{7}{4}=\pm\frac{5}{4}$

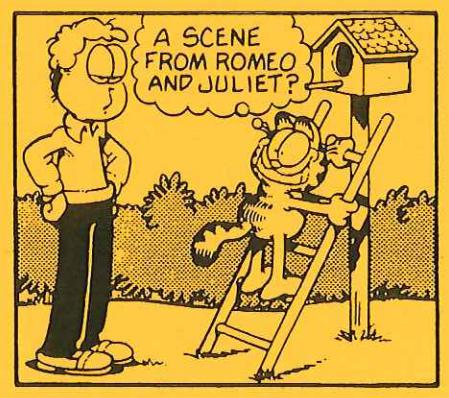
$x=\frac{7\pm5}{4}=3,\ 1/2$

$\boxed{x=3,\ 1/2}$

Completing the square and quadratic formula work on all equations







(16) $2x^2-15=-7x$

$2x^2+7x=15$

$x^2+\frac{7}{2}x=\frac{15}{2}$

$\frac{7}{4}$ $x^2+\frac{7}{2}x+\frac{49}{16}=\frac{15}{2}+\frac{49}{16}$

$(x+\frac{7}{4})^2=\frac{169}{16}$

$x+\frac{7}{4}=\pm\frac{13}{4}$

$x=\frac{-7\pm13}{4}=\frac{3}{2},-5$

$\boxed{x=3/2,-5}$

(17) $x^2+bx+c=0$

$x^2+bx=-c$

$\frac{b}{2}$ $x^2+bx+\frac{b^2}{4}=-c+\frac{b^2}{4}$

$(x+\frac{b}{2})^2=\frac{b^2-4c}{4}$

$x+\frac{b}{2}=\pm\frac{\sqrt{b^2-4c}}{2}$

$\boxed{x=\frac{-b\pm\sqrt{b^2-4c}}{2}}$

(18) $x^2+2bx+4c=0$

$x^2+2bx=-4c$

b $x^2+2bx+b^2=-4c+b^2$

$(x+b)^2=b^2-4c$

$x+b=\pm\sqrt{b^2-4c}$

$\boxed{x=-b\pm\sqrt{b^2-4c}}$

(19) $4x^2+16x+15=0$

$a=4\ \ b=16\ \ c=15$

$x=\frac{-16\pm\sqrt{(16)^2-4(4)(15)}}{2(4)}$

$x=\frac{-16\pm\sqrt{16}}{8}=\frac{-16\pm4}{8}$

$\boxed{x=-5/2,-3/2}$

(20) $x^2-8x=20$

$x^2-8x-20=0$

$a=1\ \ b=-8\ \ c=-20$

$x=\frac{-(-8)\pm\sqrt{(-8)^2-4(1)(-20)}}{2(1)}$

$x=\frac{8\pm\sqrt{144}}{2}=\frac{8\pm12}{2}$

$\boxed{x=10,-2}$

(21) $9x^2-12x-1=0$

$a=9\ \ b=-12\ \ c=-1$

$x=\frac{-(-12)\pm\sqrt{(-12)^2-4(9)(-1)}}{2(9)}$

$x=\frac{12\pm\sqrt{180}}{18}=\frac{12\pm6\sqrt{5}}{18}$

$\boxed{x=\frac{2\pm\sqrt{5}}{3}}$

(22) $5x^2+9x+3=0$

$a=5\ \ b=9\ \ c=3$

$x=\frac{-9\pm\sqrt{(9)^2-4(5)(3)}}{2(5)}$

$\boxed{x=\frac{-9\pm\sqrt{21}}{10}}$

(23) $ax^2+bx+4b=0$

$a=a\ \ b=b\ \ c=4b$

$x=\frac{-b\pm\sqrt{b^2-4a(4b)}}{2a}$

$\boxed{x=\frac{-b\pm\sqrt{b^2-16ab}}{2a}}$

(24) $ax^2-3bx+c=0$

$a=a\ \ b=-3b\ \ c=c$

$x=\frac{-(-3b)\pm\sqrt{(-3b)^2-4ac}}{2a}$

$\boxed{x=\frac{3b\pm\sqrt{9b^2-4ac}}{2a}}$

(25) $3x^2-8x-40=0$

$b^2-4ac=(-8)^2-4(3)(-40)$

$64+480=544$

$b^2-4ac>0$

$\boxed{\text{2 real roots}}$

Irrational

(26) $3x^2-8x+6=0$

$b^2-4ac=(-8)^2-4(3)(6)$

$64-72=-8$

$b^2-4ac<0$

$\boxed{\text{no real roots}}$

(27) $7x^2-6x+5=0$

$b^2-4ac=(-6)^2-4(7)(5)$

$36-140=-104$

$b^2-4ac<0$

$\boxed{\text{no real roots}}$

(28) $4x^2+4x=15$

$4x^2+4x-15=0$

$b^2-4ac=(4)^2-4(4)(-15)$

$16+240=256$

$b^2-4ac>0$

$\boxed{\text{2 real roots}}$

Rational

(29) $2x^2-8x+8=0$

$b^2-4ac=(-8)^2-4(2)(8)$

$64-64=0$

$b^2-4ac=0$

$\boxed{\text{1 real root}}$

(30) $5x^2-10x+5=0$

$b^2-4ac=(-10)^2-4(5)(5)$

$100-100=0$

$b^2-4ac=0$

1 real root

(31) $8x^2-5x-3=0$

$x^2-\frac{5}{8}x-\frac{3}{8}=0$

sum 5/8, prod −3/8

(32) $9x^2+5x+1=0$

$x^2+\frac{5}{9}x+\frac{1}{9}=0$

sum −5/9, prod 1/9

(33) $x^2-3x\sqrt{7}+14=0$

sum $3\sqrt{7}$, prod 14

(34) $x^2-5x\sqrt{3}+18=0$

sum $5\sqrt{3}$, prod 18

(35) $(\frac{3}{2})+(-4)=-5/2$

$(\frac{3}{2})(-4)=-6$

$x^2+\frac{5}{2}x-6=0$

$2x^2+5x-12=0$

(36) $(-\frac{2}{3})+(3)=7/3$

$(-\frac{2}{3})(3)=-2$

$x^2-\frac{7}{3}x-2=0$

$3x^2-7x-6=0$

(37) $(\sqrt{5})+(3\sqrt{5})=4\sqrt{5}$

$(\sqrt{5})(3\sqrt{5})=15$

$x^2-4x\sqrt{5}+15=0$

(38) $(-2\sqrt{3})+(3\sqrt{3})=\sqrt{3}$

$(-2\sqrt{3})(3\sqrt{3})=-18$

$x^2-x\sqrt{3}-18=0$

(39) $x-y=2 \quad x=2+y$

$xy=35$

$(2+y)(y)=35$

$2y+y^2=35$

$y^2+2y-35=0$

$(y+7)(y-5)=0$

$y=-7, 5$

−5, −7 & 7, 5

(40) $x+y=-10 \quad x=-10-y$

$xy=24$

$(-10-y)(y)=24$

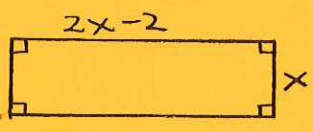
$-10y-y^2=24$

$y^2+10y+24=0$

$(y+6)(y+4)$

$y=-6, -4$ **−6, −4**

(41)



$x(2x-2)=40$

$2x^2-2x-40=0$

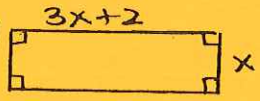
$x^2-x-20=0$

$(x-5)(x+4)=0$

$x=5, \cancel{-4}$

5 by 8 in.

(42)



$x(3x+2)=33$

$3x^2+2x-33=0$

$a=3 \quad b=2 \quad c=-33$

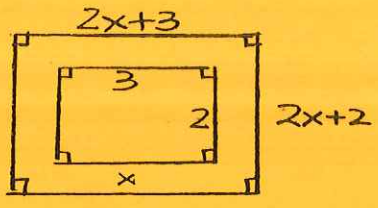
$x=\frac{-2\pm\sqrt{(2)^2-4(3)(-33)}}{2(3)}$

$x=\frac{-2\pm\sqrt{400}}{6}=\frac{-2\pm20}{6}$

$x=3, \cancel{-11/3}$

3 in by 11 in

(43)



$(2x+3)(2x+2)-(2)(3)=24$

$(4x^2+10x+6)-6=24$

$4x^2+10x-24=0$

$2x^2+5x-12=0$

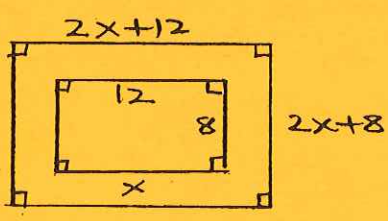
$a=2 \quad b=5 \quad c=-12$

$x=\frac{-5\pm\sqrt{(5)^2-4(2)(-12)}}{2(2)}$

$x=\frac{-5\pm\sqrt{121}}{4}=\frac{-5\pm11}{4}$

$x=\frac{3}{2}, \cancel{-4}$ **1½ cm**

(44)



$(2x+12)(2x+8)-(12)(8)=125$

$(4x^2+40x+96)-96=125$

$4x^2+40x-125=0$

$a=4 \quad b=40 \quad c=-125$

$x=\frac{-40\pm\sqrt{(40)^2-4(4)(-125)}}{2(4)}$

$x=\frac{-40\pm\sqrt{3600}}{8}=\frac{-40\pm60}{8}$

$x=5/2, \cancel{-25/2}$ **2½ ft.**

Unit 11
SKILL CHECK

① downward

② equation

③ $y = -x^2 - 8x - 16 = 0$

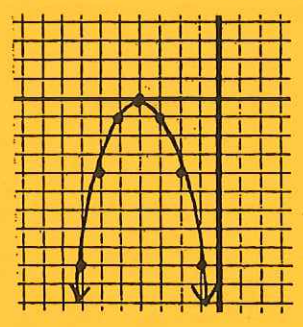
$\boxed{x = -4}$

$y = -(-4)^2 - 8(-4) - 16$

$y = 0$

$\boxed{(-4,0)}$

x	y
-2	-4
-1	-9
-3	-1



$\boxed{(-4,0)}$

④ $6x^2 - 13x + 5 = 0$

$6x^2 - 10x - 3x + 5 = 0$

$2x(3x-5) - 1(3x-5) = 0$

$(3x-5)(2x-1) = 0$

$\boxed{x = 5/3,\ 1/2}$

⑤ $4x^2 - 4x - 17 = 0$

$4x^2 - 4x = 17$

$x^2 - x = 17/4$

$-\frac{1}{2}$ $x^2 - x + 1/4 = 17/4 + 1/4$

$(x - 1/2)^2 = 18/4$

$x - 1/2 = \frac{\pm 3\sqrt{2}}{2}$

$\boxed{x = \frac{1 \pm 3\sqrt{2}}{2}}$

⑥ $9x^2 - 12x - 1 = 0$

$a=9\ \ b=-12\ \ c=-1$

$x = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(9)(-1)}}{2(9)}$

$x = \frac{12 \pm \sqrt{180}}{18} = \frac{12 \pm 6\sqrt{5}}{18}$

$\boxed{x = \frac{2 \pm \sqrt{5}}{3}}$

⑦ $3x^2 - 6x + 3 = 0$

$b^2 - 4ac = (-6)^2 - 4(3)(3)$

$b^2 - 4ac = 0$

$\boxed{1 \text{ real root}}$

Rational

⑧ Sum $\left(\frac{3}{5}\right) + (-2) = \frac{-7}{5}$

prod $\left(\frac{3}{5}\right)(-2) = \frac{-6}{5}$

$x^2 + \frac{7}{5}x - \frac{6}{5} = 0$

$\boxed{5x^2 + 7x - 6 = 0}$

⑨ $x(5x-1) = 18$

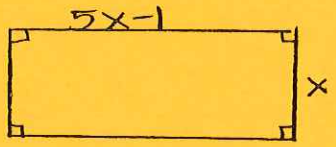
$5x^2 - x - 18 = 0$

$5x^2 - 10x + 9x - 18 = 0$

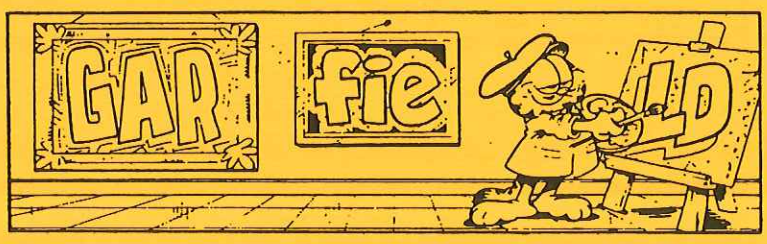
$5x(x-2) + 9(x-2) = 0$

$(x-2)(5x+9) = 0$

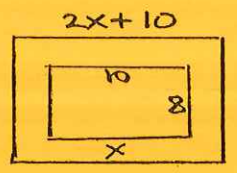
$x = 2,\ -9/5$



$\boxed{x = 2 \text{ by } 9 \text{ cm}}$



⑩



$(2x+10)(2x+8) - (8)(10) = 115$

$4x^2 + 36x + 80 - 80 = 115$

$4x^2 + 36x - 115 = 0$

$a=4\ \ b=36\ \ c=-115$

$x = \frac{-36 \pm \sqrt{(36)^2 - 4(4)(-115)}}{2(4)}$

$x = \frac{-36 \pm \sqrt{3136}}{8} = \frac{-36 \pm 56}{8}$

$x = 5/2,\ -23/2$ $\boxed{2\frac{1}{2} \text{ ft.}}$

⑪ $ax^2 - bx + 2b = 0$

$a=a\ \ b=-b\ \ c=2b$

$x = \frac{-(-b) \pm \sqrt{(-b)^2 - 4(a)(2b)}}{2a}$

$\boxed{x = \frac{b \pm \sqrt{b^2 - 8ab}}{2a}}$

Unit 11
REMEDIATION

① upward

② function

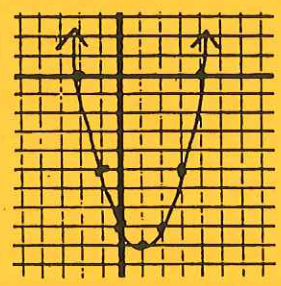
③ $y = x^2 - 2x - 8$ $\boxed{x = 1}$

$y = (1)^2 - 2(1) - 8$

$y = -9$

$\boxed{(1,-9)}$

x	y
0	-8
-1	-5
-2	0



$\boxed{(-2,0)\ (4,0)}$

④ $3x^2-10x+8=0$
$3x^2-6x-4x+8=0$
$3x(x-2)-4(x-2)=0$
$(x-2)(3x-4)=0$
$\boxed{x=2,\ 4/3}$

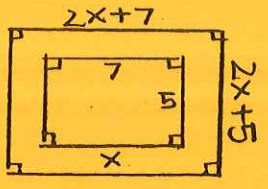
⑤ $2x^2-2x-1=0$
$-\frac{1}{2}$ $x^2-x = 1/2$
$x^2-x+1/4 = 1/2+1/4$
$(x-1/2)^2 = 3/4$
$x-1/2 = \pm\sqrt{3}/2$
$\boxed{x=\frac{1\pm\sqrt{3}}{2}}$

⑥ $4x^2-12x+3=0$
$a=4\ \ b=-12\ \ c=3$
$x=\frac{-(-12)\pm\sqrt{(-12)^2-4(4)(3)}}{2(4)}$
$x=\frac{12\pm\sqrt{96}}{8}=\frac{12\pm4\sqrt{6}}{8}$
$\boxed{x=\frac{3\pm\sqrt{6}}{2}}$

⑦ $3x^2+4x+5=0$
$b^2-4ac=(4)^2-4(3)(5)$
$b^2-4ac=-44$
$b^2-4ac<0$
$\boxed{\text{no real roots}}$

⑧ sum $(-\frac{2}{3})+(-6)=-\frac{20}{3}$
prod $(-\frac{2}{3})(-6)=4$
$\boxed{3x^2+20x+12=0}$
remember:
no fractions
$x^2+\frac{20}{3}x+4=0$

⑨ $x(x-8)=48$
$x^2-8x-48=0$
$(x-12)(x+4)=0$
$x=12,\ -4$
$\boxed{12,4 \neq -4,-12}$

⑩


$(2x+7)(2x+5)-(5)(7)=45$
$4x^2+24x+35-35=45$
$4x^2+24x-45=0$
$a=4$
$b=24$
$c=-45$
$x=\frac{-24\pm\sqrt{(24)^2-4(4)(-45)}}{2(4)}$
$x=\frac{-24\pm\sqrt{1296}}{8}=\frac{-24\pm36}{8}=3/2,\ -15/4$
$\boxed{\frac{3}{2}\text{cm}}$

⑪ $ax^2-3bx+c=0$
$a=a\ \ b=-3b\ \ c=c$
$x=\frac{-(-3b)\pm\sqrt{(-3b)^2-4(a)(c)}}{2a}$
$\boxed{x=\frac{3b\pm\sqrt{9b^2-4ac}}{2a}}$

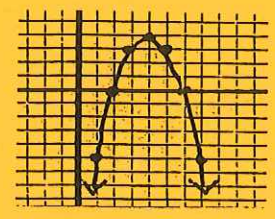
Unit 11
EXTRA PRACTICE

① downward ③ function
② upward ④ equation

⑤ $-x^2+8x-12=0$
$x=\frac{-b}{2a}\ \frac{-8}{-2}$ $\boxed{x=4}$
$y=-(4)^2+8(4)-12$
$y=4$ $\boxed{(4,4)}$

x	y
3	3
2	0
1	-5

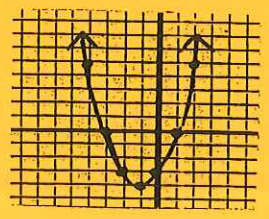
$\boxed{(2,0)\ (6,0)}$



⑥ $x^2+2x-3=0$
$x=\frac{-b}{2a}\ \frac{-2}{2}$ $\boxed{x=-1}$
$y=(-1)^2+2(-1)-3$
$y=-4$ $\boxed{(-1,-4)}$

x	y
0	-3
1	-4
2	-3

$\boxed{(-3,0)\ (1,0)}$



⑦ $x^2-5x-24=0$

$(x-8)(x+3)=0$

$\boxed{x=8,-3}$

⑧ $3x^2-13x+30=0$

$3x^2-18x+5x-30=0$

$3x(x-6)+5(x-6)=0$

$(x-6)(3x+5)=0$

$\boxed{x=6,-5/3}$

⑨ $x^2-10x+22=0$

$x^2-10x \quad =-22$

$x^2-10x+25=-22+25$

$(x-5)^2=3$

$x-5=\pm\sqrt{3}$

$\boxed{x=5\pm\sqrt{3}}$

⑩ $x^2+4x-1=0$

$x^2+4x \quad =1$

$x^2+4x+4=1+4$

$(x+2)^2=5$

$x+2=\pm\sqrt{5}$

$\boxed{x=-2\pm\sqrt{5}}$

⑪ $3x^2+5x-2=0$

$a=3 \quad b=5 \quad c=-2$

$x=\dfrac{-5\pm\sqrt{5^2-4(3)(-2)}}{2(3)}$

$x=\dfrac{-5\pm\sqrt{49}}{6}=\dfrac{-5\pm7}{6}$

$\boxed{x=-2,\ 1/3}$

⑫ $9x^2-12x-1=0$

$a=9 \quad b=-12 \quad c=-1$

$x=\dfrac{12\pm\sqrt{(-12)^2-4(9)(-1)}}{2(9)}$

$x=\dfrac{12\pm\sqrt{180}}{18}=\dfrac{12\pm6\sqrt{5}}{18}$

$\boxed{x=\dfrac{2\pm\sqrt{5}}{6}}$

⑬ $x^2-6x+11=0$

b^2-4ac

$(-6)^2-4(1)(11)=-8$

$\boxed{0 \text{ real roots}}$

⑭ $4x^2-4x+1=0$

b^2-4ac

$(-4)^2-4(4)(1)=0$

$\boxed{1 \text{ real root}}$

⑮ sum $\dfrac{2}{5}+(-2)=\dfrac{-8}{5}$

prod $\left(\dfrac{2}{5}\right)(-2)=\dfrac{-4}{5}$

$x^2+\dfrac{8}{5}x-\dfrac{4}{5}=0$

$\boxed{5x^2+8x-4=0}$

⑯ sum $2\sqrt{3}+(-5\sqrt{3})=-3\sqrt{3}$

prod $(2\sqrt{3})(-5\sqrt{3})=-30$

$\boxed{x^2+3x\sqrt{3}-30=0}$

⑰ $x(3-x)=-40$

$3x-x^2=-40$

$x^2-3x-40=0$

$(x-8)(x+5)=0$

$x \quad \boxed{8} \quad -5$

$3-x \quad \boxed{-5} \quad 8$

⑱ $x(3x-1)=44$

$3x^2-x=44$

$3x^2-x-44=0$

$a=3 \quad b=-1 \quad c=-44$

$x=\dfrac{1\pm\sqrt{(-1)^2-4(3)(-44)}}{2(3)}$

$x=\dfrac{1\pm\sqrt{529}}{6}=4,\ \dfrac{-23}{6}$

$3x-1$

x ☐

$\boxed{4 \text{ by } 11 \text{ inches}}$

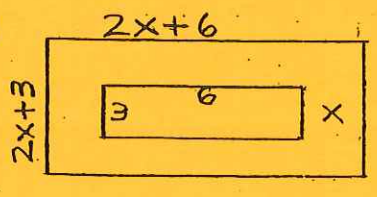
⑲ $ax^2+3bx-6b=0$

$a=a \quad b=3b \quad c=-6b$

$x=\dfrac{-3b\pm\sqrt{(3b)^2-4a(-6b)}}{2a}$

$x=\boxed{\dfrac{-3b\pm\sqrt{9b^2+24ab}}{2a}}$

⑳



$(2x+6)(2x+3)-(6)(3)=70$

$(4x^2+18x+18)-18=70$

$4x^2+18x-70=0$

$2x^2+9x-35=0$

$2x^2+14x-5x-35=0$

$2x(x+7)-5(x+7)=0$

$(x+7)(2x-5)=0$

$x=-7,\ 5/2$

$\boxed{5/2 \text{ inches wide}}$