section 7.1

2-a) $\frac{10m}{11n}$

$11n = 0$

$\frac{11n}{11} = \frac{0}{11}$

$\underline{\underline{n = 0}}$

2-b) $\frac{6y+13}{4y-9}$

$4y - 9 = 0$

$+9 \quad +9$

$4y = 9$

$\frac{4y}{4} = \frac{9}{4}$

$\underline{\underline{y = \frac{9}{4}}}$

2-c) $\frac{b-8}{b^2-36}$

$b^2 - 36 = 0$

$(b+6)(b-6) = 0$

$b+6=0 \quad | \quad b-6=0$

$-6 \; -6 \quad | \quad +6 \; +6$

$\underline{\underline{b=-6}} \quad | \quad \underline{\underline{b=6}}$

4-a) $\frac{5pq^2}{9q}$

$9q = 0$

$\frac{9q}{9} = \frac{0}{9}$

$\underline{\underline{q = 0}}$

4-b) $\frac{7a-4}{3a+5}$

$3a + 5 = 0$

$-5 \; -5$

$3a = -5$

$\frac{3a}{3} = \frac{-5}{3}$

$\underline{\underline{a = \frac{-5}{3}}}$

4-c) $\frac{1}{x^2-4}$

$x^2 - 4 = 0$

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

$x+2=0 \quad | \quad x-2=0$

$-2 \; -2 \quad | \quad +2 \; +2$

$\underline{\underline{x=-2}} \quad | \quad \underline{\underline{x=2}}$

6) $\frac{56}{63} = \frac{\cancel{(7)}^{1}(8)}{\cancel{(7)}_{1}(9)} = \underline{\underline{\frac{8}{9}}}$

8) $\frac{36v^3w^2}{27vw^3} = \frac{\cancel{36}^{4}\cancel{v^3}^{v^2}\cancel{w^2}^{1}}{\cancel{27}_{3}\cancel{v}_{1}\cancel{w^3}_{w}} = \underline{\underline{\frac{4v^2}{3w}}}$

10) $\frac{12p-240}{5p-100} = \frac{12\cancel{(p-20)}^{1}}{5\cancel{(p-20)}_{1}} = \underline{\underline{\frac{12}{5}}}$

12) $\frac{y^2+3y-4}{y^2-6y-5} = \frac{(y+4)\cancel{(y-1)}^{1}}{\cancel{(y-1)}_{1}(y-5)} = \underline{\underline{\frac{y+4}{y-5}}}$

14) $\frac{y^2-2y-3}{y^2-9} = \frac{(y+1)\cancel{(y-3)}^{1}}{(y+3)\cancel{(y-3)}_{1}} = \underline{\underline{\frac{y+1}{y+3}}}$

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16) $\frac{x^3-2x^2-25x+50}{x^2-25} = \frac{\{x^2(x-2)-25(x-2)\}}{x^2-25}$

$= \frac{(x-2)\cancel{\{x^2-25\}}^{1}}{\cancel{\{x^2-25\}}_{1}} = \frac{x-2}{1} = \underline{\underline{x-2}}$

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18) $\frac{-5c^2-10c}{-10c^2+30c+100} = \frac{\cancel{-5}^{1}c(c+2)}{\cancel{-10}_{2}(c^2-3c-10)} = \frac{c\cancel{(c+2)}^{1}}{2\cancel{(c+2)}_{1}(c-5)} = \underline{\underline{\frac{c}{2(c-5)}}}$

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20) $\frac{5r^2+30rs-35s^2}{r^2-49s^2} = \frac{5(r^2+6rs-7s^2)}{(r+7s)(r-7s)} = \frac{5\cancel{(r+7s)}^{1}(r-s)}{\cancel{(r+7s)}_{1}(r-7s)}$

$= \underline{\underline{\frac{5(r-s)}{r-7s}}}$

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22) $\frac{5-d}{d-5} = \frac{-d+5}{d-5} = \frac{-1\cancel{(d-5)}^{1}}{\cancel{(d-5)}_{1}} = \frac{-1}{1} = \underline{\underline{-1}}$

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24) $\frac{4v-32}{64-v^2} = \frac{4(v-8)}{(8+v)(8-v)} = \frac{4(-8+v)}{(8+v)(8-v)} = \frac{4(-1)\cancel{(8-v)}^{1}}{(8+v)\cancel{(8-v)}_{1}}$

$= \underline{\underline{\frac{-4}{8+v}}}$

26) $\dfrac{v^3+125}{v^2-25} = \dfrac{v^3+(5)^3}{v^2-25} = \dfrac{\overset{1}{\cancel{(v+5)}}(v^2-5v+(5)^2)}{\underset{1}{\cancel{(v+5)}}(v-5)}$

$= \dfrac{v^2-5v+25}{v-5}$

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28) $\dfrac{a^2-5a-36}{81-a^2} = \dfrac{(a+4)(a-9)}{(9+a)(9-a)} = \dfrac{(a+4)(-9+a)}{(9+a)(9-a)}$

$= \dfrac{(a+4)(-1)\overset{1}{\cancel{(9-a)}}}{(9+a)\underset{1}{\cancel{(9-a)}}} = \dfrac{-1(a+4)}{9+a} = \dfrac{-a-4}{9+a}$

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30) $\dfrac{32}{5}\cdot\dfrac{16}{24} = \dfrac{(32)\overset{2}{\cancel{(16)}}}{(5)\underset{3}{\cancel{(24)}}} = \dfrac{64}{15}$

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32) $\dfrac{12a^3b}{b^2}\cdot\dfrac{2ab^2}{9b^3} = \dfrac{\overset{4}{\cancel{(12)}}(2)(a^3)(a)\overset{1}{\cancel{(b)}}\overset{1}{\cancel{(b^2)}}}{\underset{3}{\cancel{(9)}}\underset{1}{\cancel{(b^2)}}\underset{b^2}{\cancel{(b^3)}}} = \dfrac{8a^4}{3b^2}$

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34) $\dfrac{3q^2}{q^2+q-6}\cdot\dfrac{q^2-9}{9q} = \left(\dfrac{3q^2}{(q+3)(q-2)}\right)\left(\dfrac{(q+3)(q-3)}{9q}\right)$

$= \dfrac{\overset{1}{\cancel{3}}\overset{q}{\cancel{q^2}}\overset{1}{\cancel{(q+3)}}(q-3)}{\underset{1}{\cancel{(q+3)}}(q-2)\underset{3\ 1}{\cancel{(9q)}}} = \dfrac{q(q-3)}{3(q-2)}$

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36) $\dfrac{z^2+3z}{z^2-3z-4}\cdot\dfrac{z-4}{z^2} = \left(\dfrac{z(z+3)}{(z+1)(z-4)}\right)\left(\dfrac{(z-4)}{z^2}\right)$

$= \dfrac{\overset{1}{\cancel{(z)}}(z+3)\overset{1}{\cancel{(z-4)}}}{(z+1)\underset{1}{\cancel{(z-4)}}\underset{z}{\cancel{(z^2)}}} = \dfrac{z+3}{z(z+1)}$

38) $$\frac{72m-12m^2}{8m+32}\cdot\frac{m^2+10m+24}{m^2-36}=\left(\frac{12m(6-m)}{8(m+4)}\right)\left(\frac{(m+6)(m+4)}{(m+6)(m-6)}\right)$$

$$=\frac{\cancel{12}^{3}m(-m+6)\cancel{(m+6)}\cancel{(m+4)}}{\cancel{8}_{2}\cancel{(m+4)}\cancel{(m+6)}(m-6)}=\frac{3m(-1)\cancel{(m-6)}}{2\cancel{(m-6)}}=\underline{\underline{\frac{-3m}{2}}}$$

40) $$\frac{2d^2+d-3}{d^2-16}\cdot\frac{d^2-8d+16}{2d^2-9d+18}=\left(\frac{(2d+3)(d-1)}{(d+4)(d-4)}\right)\left(\frac{(d-4)(d-4)}{(2d+3)(d-6)}\right)$$

$$=\frac{\cancel{(2d+3)}(d-1)(d-4)\cancel{(d-4)}}{(d+4)\cancel{(d-4)}\cancel{(2d+3)}(d-6)}=\underline{\underline{\frac{(d-1)(d-4)}{(d+4)(d-6)}}}$$

42) $$\frac{2n^2-3n-14}{25-n^2}\cdot\frac{n^2-10n+25}{2n^2-13n+21}=\left(\frac{(n+2)(2n-7)}{(5+n)(5-n)}\right)\left(\frac{(n-5)(n-5)}{(2n-7)(n-3)}\right)$$

$$=\frac{(n+2)\cancel{(2n-7)}(n-5)(-5+n)}{(5+n)(5-n)\cancel{(2n-7)}(n-3)}=\frac{(n+2)(n-5)(-1)\cancel{(5-n)}}{(5+n)\cancel{(5-n)}(n-3)}=\underline{\underline{\frac{-1(n+2)(n-5)}{(5+n)(n-3)}}}$$

44) $$\frac{10+w}{w-8}\div\frac{100-w^2}{8-w}=\left(\frac{10+w}{w-8}\right)\left(\frac{8-w}{100-w^2}\right)=\left(\frac{10+w}{w-8}\right)\left(\frac{-w+8}{(10+w)(10-w)}\right)$$

$$=\frac{\cancel{(10+w)}(-1)\cancel{(w-8)}}{\cancel{(w-8)}\cancel{(10+w)}(10-w)}=\underline{\underline{\frac{-1}{10-w}}}=\frac{1}{-(10-w)}=\frac{1}{-10+w}=\underline{\underline{\frac{1}{w-10}}}$$

46) $\dfrac{r^2-9}{15} \div \dfrac{r^3-27}{5r^2+15r+45} = \left(\dfrac{r^2-9}{15}\right)\left(\dfrac{5r^2+15r+45}{r^3-27}\right)$

$= \left(\dfrac{(r+3)(r-3)}{15}\right)\left(\dfrac{5(r^2+3r+9)}{r^3-(3)^3}\right) = \left(\dfrac{(r+3)(r-3)}{15}\right)\left(\dfrac{5(r^2+3r+9)}{(r-3)(r^2+3r+(3)^2)}\right)$

$= \dfrac{(r+3)\cancel{(r-3)}^{1}\cancel{(5)}^{1}\cancel{(r^2+3r+9)}^{1}}{\cancel{(15)}_{3}\cancel{(r-3)}_{1}\cancel{(r^2+3r+9)}_{1}} = \dfrac{r+3}{3}$

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50) $\dfrac{2y^2-10yz-48z^2}{2y-1} \div \dfrac{(4y^2-32yz)}{1} = \left(\dfrac{2y^2-10yz-48z^2}{(2y-1)}\right)\left(\dfrac{1}{4y^2-32yz}\right)$

$= \left(\dfrac{2(y^2-5yz-24z^2)}{(2y-1)}\right)\left(\dfrac{1}{4y(y-8z)}\right) = \dfrac{\cancel{2}^{1}(y+3z)\cancel{(y-8z)}^{1}}{(2y-1)(\cancel{4}_{2}y)\cancel{(y-8z)}_{1}}$

$= \dfrac{y+3z}{2y(2y-1)}$

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48) $\dfrac{v^3-8w^3}{2v^2+4vw+8w^2} \div \dfrac{v^2-4w^2}{4} = \left(\dfrac{v^3-(2w)^3}{2(v^2+2vw+4w^2)}\right)\left(\dfrac{4}{v^2-4w^2}\right)$

$= \left(\dfrac{(v-2w)(v^2+(v)(2w)+(2w)^2)}{2(v^2+2vw+4w^2)}\right)\left(\dfrac{4}{(v+2w)(v-2w)}\right)$

$= \dfrac{\cancel{(v-2w)}^{1}\cancel{(v^2+2vw+4w^2)}^{1}\cancel{(4)}^{2}}{\cancel{2}_{1}\cancel{(v^2+2vw+4w^2)}_{1}(v+2w)\cancel{(v-2w)}_{1}} = \dfrac{2}{v+2w}$

52) $$\frac{\dfrac{3b^2+2b-8}{12b+18}}{\dfrac{3b^2+2b-8}{2b^2-7b-15}} = \left(\frac{3b^2+2b-8}{12b+18}\right)\left(\frac{2b^2-7b-15}{3b^2+2b-8}\right)$$

$$= \frac{\cancel{(3b^2+2b-8)}(2b^2-7b-15)}{(12b+18)\cancel{(3b^2+2b-8)}} = \frac{2b^2-7b-15}{12b+18} = \frac{\cancel{(2b+3)}(b-5)}{6\cancel{(2b+3)}}$$

$$= \frac{b-5}{6}$$

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54) $$\frac{\dfrac{4d^2+7d-2}{35d+10}}{\dfrac{d^2-4}{7d^2-12d-4}} = \left(\frac{4d^2+7d-2}{35d+10}\right)\left(\frac{7d^2-12d-4}{d^2-4}\right)$$

$$= \left(\frac{(d+2)(4d-1)}{5(7d+2)}\right)\left(\frac{(7d+2)(d-2)}{(d+2)(d-2)}\right) = \frac{\cancel{(d+2)}(4d-1)\cancel{(7d+2)}\cancel{(d-2)}}{5\cancel{(7d+2)}\cancel{(d+2)}\cancel{(d-2)}}$$

$$= \frac{4d-1}{5}$$

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56) $$\frac{4n^2+32n}{3n+2} \cdot \frac{3n^2-n-2}{n^2+n-30} \div \frac{108n^2-24n}{n+6}$$

$$= \left(\frac{4n(n+8)}{(3n+2)}\right)\left(\frac{(3n+2)(n-1)}{(n+6)(n-5)}\right)\left(\frac{(n+6)}{12n(9n-2)}\right)$$

$$= \frac{\cancel{4n}^{1}(n+8)\cancel{(3n+2)}(n-1)\cancel{(n+6)}}{\cancel{(3n+2)}\cancel{(n+6)}(n-5)\cancel{(12n)}_{3}(9n-2)} = \frac{(n+8)(n-1)}{3(n-5)(9n-2)}$$

58) $\dfrac{6q+3}{9q^2-9q} \div \dfrac{q^2+14q+33}{q^2+4q-5} \cdot \dfrac{4q^2+12q}{12q+6}$

$$= \left(\frac{3(2q+1)}{9q(q-1)}\right)\left(\frac{(q+5)(q-1)}{(q+11)(q+3)}\right)\left(\frac{4q(q+3)}{6(2q+1)}\right)$$

$$= \frac{\cancel{3}(\cancel{2q+1})(q+5)(\cancel{q-1})(\cancel{4}\cancel{q})(\cancel{q+3})}{9\cancel{q}(\cancel{q-1})(q+11)(\cancel{q+3})(\cancel{6})(\cancel{2q+1})} = \underline{\underline{\frac{2(q+5)}{q(q+11)}}}$$

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60) $R(x) = \dfrac{x^3+3x^2-4x-12}{x^2-4}$

V.A. $x^2-4=0$

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

$x+2=0$	$x-2=0$
$-2\ \ -2$	$+2\ \ +2$
$x=-2$	$x=2$

domain: $\underline{\underline{(-\infty,-2)\cup(-2,2)\cup(2,\infty)}}$

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62) $R(x) = \dfrac{8x^2-32x}{2x^2-6x-80}$

V.A. $2x^2-6x-80=0$

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

$2(x+5)(x-8)=0$

$x+5=0$	$x-8=0$
$-5\ \ -5$	$+8\ \ +8$
$x=-5$	$x=8$

domain: $\underline{\underline{(-\infty,-5)\cup(-5,8)\cup(8,\infty)}}$

64) $f(x) = \dfrac{x^2-2x}{x^2+6x-16}$ $\quad g(x) = \dfrac{x^2-64}{x^2-8x}$

$$R(x) = f(x) \cdot g(x) = \left(\frac{x^2-2x}{x^2+6x-16}\right)\left(\frac{x^2-64}{x^2-8x}\right)$$

$$= \left(\frac{x(x-2)}{(x+8)(x-2)}\right)\left(\frac{(x+8)(x-8)}{x(x-8)}\right) = \frac{\cancel{x}^{1}\cancel{(x-2)}^{1}\cancel{(x+8)}^{1}\cancel{(x-8)}^{1}}{\cancel{(x+8)}_{1}\cancel{(x-2)}_{1}\cancel{(x)}_{1}\cancel{(x-8)}_{1}}$$

$$= \frac{1}{1} = \underline{\underline{1}}$$

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66) $f(x) = \dfrac{2x^2+8x}{x^2-9x+20}$ $\quad g(x) = \dfrac{x-5}{x^2}$

$$R(x) = f(x) \cdot g(x) = \left(\frac{2x^2+8x}{x^2-9x+20}\right)\left(\frac{x-5}{x^2}\right)$$

$$= \left(\frac{2x(x+4)}{(x-4)(x-5)}\right)\left(\frac{x-5}{x^2}\right) = \frac{2\cancel{x}^{1}(x+4)\cancel{(x-5)}^{1}}{(x-4)\cancel{(x-5)}_{1}\cancel{(x^2)}_{x}} = \underline{\underline{\frac{2(x+4)}{x(x-4)}}}$$

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68) $f(x) = \dfrac{24x^2}{2x-8}$ $\quad g(x) = \dfrac{4x^3+28x^2}{x^2+11x+28}$

$$R(x) = \frac{f(x)}{g(x)} = \frac{\left(\frac{24x^2}{2x-8}\right)}{\left(\frac{4x^3+28x^2}{x^2+11x+28}\right)} = \left(\frac{24x^2}{2x-8}\right)\left(\frac{x^2+11x+28}{4x^3+28x^2}\right)$$

$$= \left(\frac{24x^2}{2(x-4)}\right)\left(\frac{(x+7)(x+4)}{4x^2(x+7)}\right) = \frac{\cancel{24}^{3}\cancel{(x^2)}^{1}\cancel{(x+7)}^{1}(x+4)}{\cancel{2}_{1}(x-4)\cancel{(4)}_{1}\cancel{(x^2)}_{1}\cancel{(x+7)}_{1}}$$

$$= \underline{\underline{\frac{3(x+4)}{x-4}}}$$

70) $f(x) = \dfrac{24x^2}{2x-4}$ $\qquad g(x) = \dfrac{12x^2+36x}{x^2-11x+18}$

$$R(x) = \frac{f(x)}{g(x)} = \frac{\left(\dfrac{24x^2}{2x-4}\right)}{\left(\dfrac{12x^2+36x}{x^2-11x+18}\right)} = \left(\frac{24x^2}{2x-4}\right)\left(\frac{x^2-11x+18}{12x^2+36x}\right)$$

$$= \left(\frac{24x^2}{2(x-2)}\right)\left(\frac{(x-2)(x-9)}{12x(x+3)}\right) = \frac{\overset{\overset{1}{\cancel{12}}}{\cancel{24}}\,\overset{x}{\cancel{(x^2)}}\,\overset{1}{\cancel{(x-2)}}\,(x-9)}{\underset{1}{\cancel{2}}\,\underset{1}{\cancel{(x-2)}}\,\underset{1}{\cancel{(12)}}\,\underset{1}{\cancel{(x)}}\,(x+3)}$$

$$= \frac{x(x-9)}{x+3}$$