Lösungen (Negative Zahlen)

Afg 1

1) $6-5-8 = -7$

2) $-3+2+(-9) = -3+2-9 = -10$

3) $10-(-6)+3-(-2) = 10+6+3+2 = 21$

4) $-(-1)-7+12 = 1-7+12 = 6$

5) $-8-2+(-3)+1 = -8-2-3+1 = -12$

6) $(-5)-(-13)+(-8) = -5+13-8 = 0$

7) $20+(-9)-(+12) = 20-9-12 = -1$

8) $(+6)-(+1)+(-15) = 6-1-15 = -10$

9) $-(+7)+(-4)-(-6)-3 = -7-4+6-3 = -8$

10) $0-(-8)+(-10)-2 = 8-10-2 = -4$

Afg 2

1) $-5 \cdot 3+9 = -15+9 = -6$

2) $(-2) \cdot 7-1 = -14-1 = -15$

3) $2-6 \cdot 3+10 = 2-18+10 = -6$

4) $-5(-6)+3(-7) = 30-21 = 9$

5) $(-3)(-4)-(-2) \cdot 6 = 12+12 = 24$

6) $-(-9)(-3)-2(-7) = -27+14 = -13$

7) $-(-2)(-3) \cdot 4-(-1)(-7) = -24-7 = -31$

8) $6-(-2)(-4)(-3)(-1)+(-1)(-5) = 6-24-5 = -23$ ②

9) $4(-3)+(-5)^2-4^2 = -12+25-16 = -3$

10) $(-3)^2(-4)-(-2)\cdot 6 = 9(-4)+12 = -36+12 = -24$

Aufg 3

1) $3(7-9)-(-6+5) = 3(-2)-(-1) = -6+1 = -5$

2) $-4\big(5+2(-3)\big)+(-7)\cdot 3 = -4(5-6)-21 = -4(-1)-21$
$= 4-21 = -17$

3) $(-3)\Big(-8-(-3)(-4)\Big)-\big(3+(-2)\cdot 5\big) = (-3)(-8-12)-(3-10)$
$= (-3)(-20)-(-7) = 60+7 = 67$

4) $\big(-3\cdot 2+4\big)\big(-(-4\cdot 6)\big) = (-6+4)(24) = (-2)\cdot 24 = -48$

5) $\Big(-(3-5)^2+(-5)^2\Big)\Big(-(-3)^2+7\Big) = \big(-(-2)^2+25\big)(-9+7)$
$= (-4+25)(-2) = 21(-2) = -42$

6) $-\Big(-(-4+3)(2-3)+(-2)\Big)^3 = -\big(-(-1)(-1)-2\big)^3 = -(1-2)^3 = -(-1)^3$
$= -(-1) = 1$

7) $\big(-(5-7)(-2)+1\big)\big(1-(-1)(-2)\big) = \big(-(-2)(-2)+1\big)(1-2)$
$= (-4+1)(-1) = (-3)(-1) = 3$

8) $\big((-1)^3-2\big)^3\big(2-(-2)^2\big) = (-1-2)^3(2-4) = (-3)^3(-2) = -27(-2)$
$= 54$

9) $\big(-(-1)(-2)-1\big)\big(2(3-4)+1\big)(6-4\cdot 2) = (-2-1)\big(2(-1)+1\big)(6-8)$
$= (-3)(-2+1)(-2) = (-3)(-1)(-2) = -6$

10) $\underbrace{-(-1)}_{=1}\Big(-(-2+1)-(-1)^3\Big) = -(-1)-(-1) = 1+1 = 2$

Afg 4 (Brüche kürzen)

1) $\frac{6}{15} = \frac{2 \cdot 3}{5 \cdot 3} = \frac{2}{5}$

2) $\frac{28}{21} = \frac{4 \cdot 7}{3 \cdot 7} = \frac{4}{3} = 1\frac{1}{3}$

3) $\frac{40}{35} = \frac{8 \cdot 5}{7 \cdot 5} = \frac{8}{7} = 1\frac{1}{7}$

4) $\frac{36}{45} = \frac{4 \cdot 9}{5 \cdot 9} = \frac{4}{5}$

5) $\frac{26}{39} = \frac{2 \cdot 13}{3 \cdot 13} = \frac{2}{3}$

6) $\frac{42}{54} = \frac{7 \cdot 6}{9 \cdot 6} = \frac{7}{9}$

7) $\frac{15ab}{21cdd} = \frac{5 \cdot 3\,b}{7 \cdot 3\,cd} = \frac{5b}{7cd}$

8) $\frac{18x^{1}y a}{14y^{1}zx} = \frac{9 \cdot 2\,x\,a}{7 \cdot 2\,y} = \frac{9xa}{7y}$

9) $\frac{14a^{1}x^{2}ym^{2}}{42a^{3}x^{3}y^{2}m} = \frac{14\,am^{2}}{3 \cdot 14\,x^{3}y} = \frac{am^{2}}{3x^{3}y}$

10) $\frac{18p(x-3)^{1}a^{5}4}{15qxp^{2}(x-3)} = \frac{6 \cdot 3(x-3)a^{4}}{5 \cdot 3xp} = \frac{6(x-3)a^{4}}{5xp}$

11) $$\frac{24r^{2}\cancel{(a^2-b)m}}{27(a^2-b)^{1}\cancel{r}\,m^{1}} = \frac{8\cdot\cancel{3}\,r^2}{9\cdot\cancel{3}(a^2-b)m} = \frac{8r^2}{9(a^2-b)m}$$

12) $$\frac{9x^{2}\cancel{(-y)}\cancel{(a+mb)}}{6(a+mb)^{2}\cancel{x(-y)}} = \frac{3\cdot\cancel{3}x^2}{2\cdot\cancel{3}(a+mb)^2} = \frac{3x^2}{2(a+mb)^2}$$

13) $$\frac{12(x-y)(ab)^3x^2}{30x^4(y-x)ba} = \frac{2\cdot\cancel{6}\cancel{(x-y)}a^{2}b^{2}\cancel{x^2}}{-5\cdot\cancel{6}x^{2}\cancel{(x-y)}\cancel{ba}} = -\frac{2a^2b^2}{5x^2}$$

↑ beachte: $y-x = -(x-y)$ *)

14) $$\frac{16(-x)a^{2}b^{3}\cancel{(c-y)^2}}{24a^{1}\cancel{(c-y)^{1}}xb^2} = \frac{-2\cdot\cancel{8}xb^3}{3\cdot\cancel{8}a(c-y)\cancel{x}} = -\frac{2b^3}{3a(c-y)}$$

↑ beachte: $16(-x) = -16x$

15) $$\frac{24(b-a)^2\cancel{x^2}a^3}{36(a-b)^3x^{2}b} = \frac{2\cdot\cancel{12}\cancel{(a-b)^2}a^3}{3\cdot\cancel{12}(a-b)^{1}x^2b} = \frac{2a^3}{3(a-b)x^2b}$$

↑ beachte: $(b-a)^2 = (a-b)^2$ *)

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*) $$-(x-y) = -x+y = y-x$$

$$(b-a)^2 = \big(-(a-b)\big)^2 = (-1)^2(a-b)^2 = (a-b)^2$$

Afg 5 (Brüche erweitern)

1) $\frac{3}{5} = \frac{?}{15}$; $15:5=3 \Rightarrow$ erweitere mit 3

$$\frac{3}{5} = \frac{3 \cdot 3}{5 \cdot 3} = \frac{9}{15}$$

2) $\frac{7}{8} = \frac{?}{24}$; $24:8=3 \Rightarrow$ erweitere mit 3

$$\frac{7}{8} = \frac{7 \cdot 3}{8 \cdot 3} = \frac{21}{24}$$

3) $\frac{4}{7} = \frac{?}{35}$; $35:7=5 \Rightarrow$ erweitere mit 5

$$\frac{4}{7} = \frac{4 \cdot 5}{7 \cdot 5} = \frac{20}{35}$$

4) $3 = \frac{?}{7} \Leftrightarrow \frac{3}{1} = \frac{?}{7} \Rightarrow$ erweitere mit 7

$$3 = \frac{3}{1} = \frac{3 \cdot 7}{1 \cdot 7} = \frac{21}{7}$$

5) $\frac{6}{5} = \frac{?}{40}$; $40:5=8 \Rightarrow$ erweitere mit 8

$$\frac{6}{5} = \frac{6 \cdot 8}{5 \cdot 8} = \frac{48}{40}$$

6) $\frac{4}{6} = \frac{?}{42}$; $42:6=7 \Rightarrow$ erweitere mit 7

$$\frac{4}{6} = \frac{4 \cdot 7}{6 \cdot 7} = \frac{28}{42}$$

7) $\frac{3a}{9} = \frac{?}{27b}$; $27b : 9 = 3b \Rightarrow$ erweitre mit $3b$

$$\frac{3a}{9} = \frac{3a \cdot 3b}{9 \cdot 3b} = \frac{9ab}{27b}$$

8) $\frac{2xy^2}{5a} = \frac{?}{35ax}$; $35ax : 5a = 7x$

$$\frac{2xy^2}{5a} = \frac{2xy^2 \cdot 7x}{5a \cdot 7x} = \frac{14x^2y^2}{35ax}$$

9) $\frac{7a^2xy}{6m} = \frac{?}{18m^2x}$; $18m^2x : 6m = 3mx$

$$\frac{7a^2xy}{6m} = \frac{7a^2xy \cdot 3mx}{6m \cdot 3mx} = \frac{21a^2x^2ym}{18m^2x}$$

10) $x = \frac{?}{4x} \Longleftrightarrow \frac{x}{1} = \frac{?}{4x} \Rightarrow$ mit $4x$ erweitern!

$$x = \frac{x}{1} = \frac{x \cdot 4x}{1 \cdot 4x} = \frac{4x^2}{4x}$$

11) $xy = \frac{?}{3x^2ab} \Rightarrow$ mit $3x^2ab$ erweitern

$$xy = \frac{xy}{1} = \frac{xy \cdot 3x^2ab}{1 \cdot 3x^2ab} = \frac{3x^3yab}{3x^2ab}$$

12) $\frac{4pa}{7x} = \frac{?}{42a^2xp}$; $42a^2xp : 7x = 6a^2p$

$$\frac{4pa}{7x} = \frac{4pa \cdot 6a^2p}{7x \cdot 6a^2p} = \frac{24p^2a^3}{42a^2xp}$$

13) $\frac{8xy^3}{9a(x-y)} = \frac{?}{54a^3(x-y)^2}$; $\frac{\overset{6}{\cancel{54}}\,\overset{2}{a^3}(x-y)^{\overset{1}{2}}}{\cancel{9a(x-y)}} = 6a^2(x-y)$

$$\frac{8xy^3}{9a(x-y)} = \frac{8xy^3 \cdot 6a^2(x-y)}{9a(x-y) \cdot 6a^2(x-y)} = \frac{48xy^3a^2(x-y)}{54a^3(x-y)^2}$$

14) $\frac{5x}{-a} = \frac{?}{2ab}$; $2ab : (-a) = -2b$

$$\frac{5x}{-a} = \frac{5x \cdot (-2b)}{-a \cdot (-2b)} = \frac{-10bx}{2ab} \left(= -\frac{10bx}{2ab} \right)$$

15) $\frac{4ym^2}{a-b} = \frac{?}{7m(b-a)}$; $\frac{7m(b-a)}{a-b} = \frac{-7m\cancel{(a-b)}}{\cancel{a-b}} = -7m$

$$\frac{4ym^2}{a-b} = \frac{4ym^2 \cdot (-7m)}{(a-b) \cdot (-7m)} = \frac{-28ym^3}{7m(b-a)}$$

beachte: $b-a = -(a-b)$

Afg 6 (Brüche multiplizieren)

1) $\left(-\frac{3}{4}\right)\cdot\frac{5}{7} = -\frac{3\cdot 5}{4\cdot 7} = -\frac{15}{28}$

2) $\frac{2}{9}\left(-\frac{4}{5}\right) = -\frac{2\cdot 4}{9\cdot 5} = -\frac{8}{45}$

3) $\frac{\cancel{1}}{6}\cdot\frac{7}{\cancel{4}} = \frac{1\cdot 7}{6\cdot 4} = \frac{7}{24}$

4) $\left(-\frac{2}{7}\right)\left(-\frac{3}{5}\right) = \frac{2\cdot 3}{7\cdot 5} = \frac{6}{35}$

5) $3\cdot\frac{4}{7} = \frac{3}{1}\cdot\frac{4}{7} = \frac{3\cdot 4}{1\cdot 7} = \frac{12}{7} = 1\frac{5}{7}$

6) $4\cdot\frac{2}{9}\cdot\frac{1}{7} = \frac{4}{1}\cdot\frac{2}{9}\cdot\frac{1}{7} = \frac{4\cdot 2\cdot 1}{1\cdot 9\cdot 7} = \frac{8}{63}$

7) $\frac{2a}{5x^2}\cdot\frac{3b^2}{7y} = \frac{2a\cdot 3b^2}{5x^2\cdot 7y} = \frac{6ab^2}{35x^2y}$

8) $m\cdot\frac{5x}{2y}\cdot\frac{a^2}{b} = \frac{m}{1}\cdot\frac{5x}{2y}\cdot\frac{a^2}{b} = \frac{m\cdot 5x\cdot a^2}{1\cdot 2y\cdot b} = \frac{5a^2mx}{2by}$

9) $(-5)\cdot\frac{\cancel{3}}{4}\cdot\frac{1}{\cancel{7}} = -\frac{5}{1}\cdot\frac{3}{4}\cdot\frac{1}{7} = -\frac{15}{28}$

10) $\frac{x}{a-b}\cdot\frac{3y}{b-a} = \frac{x\cdot 3y}{(a-b)(b-a)} = \frac{3xy}{-(a-b)(a-b)} = -\frac{3xy}{(a-b)^2}$

beachte $b-a = -(a-b)$

11) $\frac{2}{x} \cdot \frac{5x}{3} = \frac{2 \cdot 5x}{x \cdot 3} = \frac{10}{3} = 3\frac{1}{3}$

12) $\frac{4x}{3(m-n)} \cdot \frac{2 \cdot 3(m-n)}{5x^2y} = \frac{8}{5xy}$

13) $\frac{5m}{2(x-y)} \cdot \frac{2 \cdot 4(y-x)}{3a^2m} = \frac{10(y-x)}{3a^2(x-y)} = -\frac{10(x-y)}{3a^2(x-y)}$

$= -\frac{10}{3a^2}$

14) $\frac{21^3}{10} \cdot \frac{10}{7} = 3$

15) $\frac{12}{18} \cdot \frac{63}{4} = \frac{3 \cdot 4}{2 \cdot 3} \cdot \frac{9 \cdot 7}{4} = \frac{21}{2} = 10\frac{1}{2}$

Aufg 7: (Brüche dividieren)

1) $\frac{3}{7} : \frac{4}{5} = \frac{3}{7} \cdot \frac{5}{4} = \frac{15}{28}$

2) $\frac{5x^2}{6a} : \frac{20xy}{3a^2} = \frac{5x^{\cancel{2}1}}{2\cancel{6}a} \cdot \frac{\cancel{3}a^{\cancel{2}1}}{\overset{4}{\cancel{20}}xy} = \frac{ax}{8y}$

3) $\frac{4mp^3}{9ab} : \frac{8a}{3b^2} = \frac{4mp^3}{\overset{3}{\cancel{9}}ab} \cdot \frac{3b^{\cancel{2}1}}{\underset{2}{\cancel{8}}a} = \frac{mbp^3}{6a^2}$

4) $\frac{72a^3bx}{7ym} : \frac{6ax^2}{35(-y)} = \frac{\overset{12}{\cancel{72}}a^{\cancel{3}2}b\cancel{x}}{7ym} \cdot \frac{\overset{5}{\cancel{35}}(-y)}{\cancel{6}ax^{\cancel{2}1}} = -\frac{60a^2b}{mx}$

5) $\frac{25(x-1)t}{16p^2x} : \frac{15t^2(1-x)}{8x^2p} = \frac{5 \cdot \cancel{5}(x-1)\cancel{t}}{\underset{2}{\cancel{16}}p^{\cancel{2}1}\cancel{x}} \cdot \frac{\cancel{8}x^{\cancel{2}1}p}{-\cancel{3}\cdot\cancel{t}^{\cancel{2}1}(x-1)} = -\frac{5x}{6pt}$

6) $\frac{48r(t-2)^2}{10a^3(b-a)} : \frac{42(2-t)}{5(a-b)^3a^2} = \frac{6\cdot 8r(2-t)^2}{-10a^2(a-b)} \cdot \frac{5(a-b)^3a^2}{6\cdot 7(2-t)}$

$= \frac{8r(2-t)(a-b)^2}{-2a\cdot 7} = \frac{4r(t-2)(a-b)^2}{7a}$ (10)

beachte: $\frac{2-t}{-1} = t-2$

7) $\frac{30(-a)^3b^2}{21x^2(m-n)} : \frac{20a^2}{56(n-m)^2} = \frac{-30a^3b^2}{3\cdot 7x^2(m-n)} \cdot \frac{3\cdot 8(m-n)^2}{20a^2}$

$= \frac{-10\cdot 2ab^2(m-n)}{5x^2} = \frac{4ab^2(n-m)}{x^2}$

8) $\frac{49\cdot 2ap^4}{15\cdot 9(-r+s)} : \frac{7\cdot 4p^3}{9(r-s)} = \frac{49\cdot 2ap^4}{15\cdot 9(s-r)} \cdot \frac{9(r-s)}{3\cdot 4p^3}$

$= \frac{7ap(r-s)}{30(s-r)} = -\frac{7ap(r-s)}{30(r-s)} = -\frac{7ap}{30}$

9) $4x^2ap^3 : \frac{6x^2pa^3}{5(p-a)} = \frac{4x^2ap^3}{1} \cdot \frac{5(p-a)}{6x^2pa^3}$

$= \frac{10p^2(p-a)}{3a^2}$

10) $\frac{18l^4n^3(n-1)}{10ax} : (12(n-1)l) = \frac{18l^4n^3(n-1)}{10ax} \cdot \frac{1}{12(n-1)l}$

$= \frac{9l^3n^3}{5\cdot 12ax} = \frac{3l^3n^3}{20ax}$

11) $\frac{5t^3a}{7xb^2} : \frac{15ta^2}{14x^3b} : \frac{2tx}{b} = \frac{5t^3a}{7xb^2} \cdot \frac{14x^3b}{15ta^2} \cdot \frac{b}{2tx}$

$= \frac{5 \cdot 14\, t^3 a x^3 b^2}{14 \cdot 15\, x^2 b^2 t^2 a^2} = \frac{tx}{3a}$

12) $\frac{x^2}{a} : \frac{x}{a^3b : x} = \frac{x^2}{a} : \left(x : \frac{a^3b}{x}\right)$

$= \frac{x^2}{a} : \left(\frac{x}{1} \cdot \frac{x}{a^3b}\right) = \frac{x^2}{a} : \frac{x^2}{a^3b} = \frac{x^2}{a} \cdot \frac{a^3b}{x^2}$

$= a^2b$

Aufg 8: (Addieren und Subtrahieren von Brüchen)

1) $\frac{3}{4} + \frac{2}{5} = \frac{3 \cdot 5}{4 \cdot 5} + \frac{2 \cdot 4}{5 \cdot 4} = \frac{15}{20} + \frac{8}{20} = \frac{23}{20} = 1\frac{3}{20}$

2) $\frac{2}{7} + \frac{5}{14} = \frac{2 \cdot 2}{7 \cdot 2} + \frac{5}{14} = \frac{4}{14} + \frac{5}{14} = \frac{9}{14}$

3) $\frac{7}{21} + \frac{4}{3} = \frac{1}{3} + \frac{4}{3} = \frac{5}{3} = 1\frac{2}{3}$

4) $\frac{5}{6} + \frac{3}{8} = \frac{5 \cdot 4}{24} + \frac{3 \cdot 3}{24} = \frac{20}{24} + \frac{9}{24} = \frac{29}{24}$

$= 1\frac{5}{24}$

5) $\frac{3}{10} - \frac{2}{15} = \frac{3 \cdot 3 - 2 \cdot 2}{30} = \frac{9-4}{30} = \frac{5}{30} = \frac{1}{6}$

6) $\frac{5}{6} - \frac{3}{14} = \frac{5 \cdot 7 - 3 \cdot 3}{42} = \frac{35-9}{42} = \frac{26}{42} = \frac{13}{21}$

7) $\frac{5}{12} - \frac{7}{18} = \frac{5\cdot 3 - 7\cdot 2}{36} = \frac{15-14}{36} = \frac{1}{36}$

8) $-\frac{1}{6} + \frac{4}{9} = \frac{\cdot -1\cdot 3 + 4\cdot 2}{18} = \frac{-3+8}{18} = \frac{5}{18}$

9) $3 + \frac{2}{7} = \frac{21}{7} + \frac{2}{7} = \frac{23}{7}$

10) $1 - \frac{4}{5x} = \frac{5x}{5x} - \frac{4}{5x} = \frac{5x-4}{5x}$

11) $\frac{7}{12a} + \frac{4}{15b} = \frac{7\cdot 5b + 4\cdot 4a}{60ab} = \frac{16a+35b}{60ab}$

12) $\frac{5}{8a^2} - \frac{1}{12a} = \frac{5\cdot 3 - 1\cdot 2a}{24a^2} = \frac{15-2a}{24a^2}$

13) $\frac{3}{4x^2y} - \frac{5}{6xy^3} = \frac{3\cdot 3y^2 - 5\cdot 2x}{12x^2y^3} = \frac{9y^2-10x}{12x^2y^3}$

14) $-\frac{3}{14xy} - \frac{4}{21x} = \frac{-3\cdot 3 - 4\cdot 2y}{42xy} = \frac{-9-8y}{42xy}$

15) $\frac{7}{10m^2x} - \frac{5}{12my} = \frac{7\cdot 6y - 5\cdot 5mx}{60m^2xy} = \frac{42y-25mx}{60m^2xy}$

16) $\frac{2}{9(a-b)x^2} + \frac{7}{12ax} = \frac{2\cdot 4a + 7\cdot 3x(a-b)}{36ax^2(a-b)}$

$= \frac{8a + 21x(a-b)}{36ax^2(a-b)}$

Afg 9

1) $-\left(-\frac{1}{3}\right)\cdot\left(-\frac{6}{7}\right) = -\frac{1}{3}\cdot\frac{6}{7} = -\frac{2}{7}$

2) $\left(\frac{5}{-9}+\frac{1}{3}\right)\cdot\left(-\frac{6}{7}\right)\cdot\left(-\frac{1}{2}\right) = \frac{5-3}{-9}\cdot\frac{6^{3}}{7}\cdot\frac{1}{2} = -\frac{2}{3}\cdot\frac{3}{7}$

$= -\frac{2}{21}$

3) $\left(-\frac{2}{5}\right):\left(\frac{-4}{7}\right) = -\frac{2}{5}\cdot\left(-\frac{7}{4}\right) = \frac{2}{5}\cdot\frac{7}{4_{2}} = \frac{7}{10}$

4) $\left(\frac{1}{5}-\frac{2}{3}\right):\left(-\frac{7}{20}\right) = \frac{3-10}{15}\cdot\left(-\frac{20}{7}\right)$

$= -\frac{7}{15}\cdot\left(-\frac{20}{7}\right) = \frac{7}{15_{3}}\cdot\frac{20^{4}}{7} = \frac{4}{3} = 1\frac{1}{3}$

5) $-\left(-\frac{7}{4}\right)\left(-\frac{4}{5}\right)\cdot(-5) = \frac{7}{4}\cdot\frac{4}{5}\cdot\frac{5}{1} = 7$

6) $\left(\frac{2}{7}-\frac{-1}{3}\right):\left(-\frac{5}{3}\right) = \frac{6+7}{21}\cdot\left(-\frac{3}{5}\right) = -\frac{13}{21_{7}}\cdot\frac{3}{5}$

$= -\frac{13}{35}$

7) $-\left(1-\frac{1}{8}\right)\left(\frac{1}{4}-1\right):\left(-\frac{7}{16}\right) = -\left(\frac{8}{8}-\frac{1}{8}\right)\left(\frac{1}{4}-\frac{4}{4}\right)\cdot\left(-\frac{16}{7}\right)$

$= -\frac{7}{8}\left(-\frac{3}{4}\right)\left(-\frac{16}{7}\right) = -\frac{7}{8}\cdot\frac{3}{4}\cdot\frac{16^{4}}{7} = -\frac{3\cdot 4}{8_{2}}$

$= -\frac{3}{2} = -1\frac{1}{2}$

8) $\left(\frac{-2}{\frac{3}{5}}:\frac{5}{6}\right)\cdot\left(\frac{1}{-7}\right) = \left(\frac{-2}{1}:\frac{-3}{5}:\frac{5}{6}\right)\left(-\frac{1}{7}\right)$

$= -\frac{2}{1}\cdot\left(-\frac{5}{3}\right)\cdot\frac{6}{5}\left(-\frac{1}{7}\right) = -\frac{2}{1}\cdot\frac{5}{1}\cdot\frac{2^{2}}{5}\cdot\frac{1}{7} = -\frac{4}{7}$

9) $-\left(\frac{1}{12}+\frac{1}{15}\right)\cdot\left(-\frac{20}{3}\right) = -\frac{5+4}{60}\cdot\left(-\frac{20}{3}\right)$

$= \frac{\cancel{9}^{3}}{\cancel{60}_{3}}\cdot\frac{\cancel{20}}{\cancel{3}} = \frac{3}{3} = 1$

10) $\left(\frac{1}{15}-\frac{3}{10}\right):\left(\frac{7}{-10}\right) = \frac{2-9}{30}\cdot\left(-\frac{10}{7}\right)$

$= -\frac{7}{30}\left(-\frac{10}{7}\right) = \frac{\cancel{7}}{\cancel{30}}\cdot\frac{\cancel{10}}{\cancel{7}} = \frac{1}{3}$

11) $\left(\frac{1}{4}-1\right)\left(\frac{2}{3}-1\right):\left(1-\frac{3}{8}\right) = \left(\frac{1}{4}-\frac{4}{4}\right)\left(\frac{2}{3}-\frac{3}{3}\right):\left(\frac{8}{8}-\frac{3}{8}\right)$

$= -\frac{3}{4}\left(-\frac{1}{3}\right):\frac{5}{8} = \frac{\cancel{3}}{\cancel{4}}\cdot\frac{1}{\cancel{3}}\cdot\frac{8^{2}}{5} = \frac{2}{5}$

12) $\left(\frac{1}{21}-\frac{1}{6}\right)\cdot\left(\frac{3}{10}-\frac{4}{25}\right) = \frac{2-7}{42}\cdot\frac{15-8}{50}$

$= -\frac{\cancel{5}}{\cancel{42}_{6}}\cdot\frac{\cancel{7}}{\cancel{50}_{10}} = -\frac{1}{60}$

13) $-\left(\frac{1}{15}+\frac{1}{20}\right)\cdot\left(-\frac{15}{14}\right) = \frac{4+3}{60}\cdot\frac{15}{14} = \frac{\cancel{7}}{\cancel{60}_{4}}\cdot\frac{\cancel{15}}{\cancel{14}_{2}} = \frac{1}{8}$

14) $\left(\frac{1}{12}+\frac{1}{18}-\frac{1}{6}\right):\left(\frac{-1}{-12}\right) = \frac{3+2-6}{36}\cdot\frac{12}{1}$

$= -\frac{1}{36}\cdot\frac{12}{1} = -\frac{1}{3}$

15) $\frac{\frac{1}{7}-4}{2-\frac{7}{8}} \cdot \left(\frac{9}{16}-1\right) = \left(\frac{1}{7}-4\right) : \left(2-\frac{7}{8}\right) \cdot \left(\frac{9}{16}-1\right)$

$= \left(\frac{1}{7}-\frac{28}{7}\right) : \left(\frac{16}{8}-\frac{7}{8}\right) \cdot \left(\frac{9}{16}-\frac{16}{16}\right)$

$= -\frac{27}{7} : \frac{9}{8} \cdot \left(-\frac{7}{16}\right) = \frac{\cancel{27}^{3}}{\cancel{7}} \cdot \frac{\cancel{8}}{\cancel{9}} \cdot \frac{\cancel{7}}{\cancel{16}_{2}} = \frac{3}{2} = 1\frac{1}{2}$

16) $\left(\frac{1}{75}-\frac{1}{10}-\frac{1}{6}\right) : \left(\frac{1}{70}+\frac{1}{14}-\frac{1}{55}\right) = \frac{2-3-5}{30} : \frac{7+5-2}{70}$

$= -\frac{6}{30} : \frac{10}{70} = -\frac{1}{5} : \frac{1}{7} = -\frac{1}{5} \cdot \frac{7}{1} = -\frac{7}{5}$

$= -1\frac{2}{5}$

17) $\left(\frac{5}{18}+\frac{1}{24}-\frac{7}{36}\right) : \left(\frac{1}{6}-\frac{7}{8}-\frac{1}{12}\right) = \frac{20+3-14}{72} : \frac{4-21-2}{24}$

$= \frac{9}{\cancel{72}_{8}} : \left(-\frac{19}{24}\right) = -\frac{1}{\cancel{8}} \cdot \frac{\cancel{24}^{3}}{19} = -\frac{3}{19}$

18) $\left(\frac{1}{21}-\frac{1}{14}+\frac{-1}{6}\right) : \left(\frac{1}{20}-\frac{1}{12}-\frac{1}{10}\right) = \frac{2-3-7}{42} : \frac{3-5-6}{60}$

$= -\frac{8}{42} : \left(-\frac{8}{60}\right) = \frac{\cancel{8}}{42} \cdot \frac{60}{\cancel{8}} = \frac{\cancel{6} \cdot 10}{\cancel{6} \cdot 7} = \frac{10}{7}$

$= 1\frac{3}{7}$

Afj 10

1) $\frac{a}{3} - \frac{5b}{7} = \frac{7a - 15b}{21}$

2) $\frac{n}{6xa^2} + \frac{m}{8x^3a} = \frac{n \cdot 4x^2 + m \cdot 3a}{24x^3a^2} = \frac{4nx^2 + 3am}{24x^3a^2}$

3) $a + \frac{4x}{3m} = \frac{a}{1} + \frac{4x}{3m} = \frac{3am + 4x}{3m}$

4) $\frac{3t}{2a} - \frac{9at - p}{6a^2} = \frac{3t \cdot 3a - (9at - p)}{6a^2}$

$= \frac{9at - 9at + p}{6a^2} = \frac{p}{6a^2}$

5) $\left(\frac{5}{3} + \frac{a}{2m}\right) \cdot \frac{3am^2}{10m + 3a} = \frac{10m + 3a}{6m} \cdot \frac{3am^2}{10m + 3a}$

$= \frac{3am^2}{6m} = \frac{am}{2}$

6) $\left(\frac{x}{a^2b} - \frac{p}{3ab^2}\right) : \frac{3bx - pa}{3ab^2} = \frac{3bx - pa}{3a^2b^2} \cdot \frac{3ab^2}{3bx - pa}$

$= \frac{3ab^2}{3a^2b^2} = \frac{1}{a}$

7) $\left(\frac{1}{x} - \frac{a}{b}\right) \cdot \frac{bx}{(b - ax)^3} = \frac{b - ax}{bx} \cdot \frac{bx}{(b - ax)^3}$

$= \frac{1}{(b - ax)^2}$

8) $\left(1-\frac{b-2a}{a+b}\right):\frac{9a^2}{(a+b)^2}=\left(\frac{a+b}{a+b}-\frac{b-2a}{a+b}\right)\cdot\frac{(a+b)^2}{9a^2}$

$=\frac{(a+b)-(b-2a)}{a+b}\cdot\frac{(a+b)^2}{9a^2}=\frac{a+b-b+2a}{a+b}\cdot\frac{(a+b)^2}{9a^2}$

$=\frac{3a}{a+b}\cdot\frac{(a+b)^2}{9a^2}=\frac{a+b}{3a}$ (17)

Afg 11:

1) $\frac{a}{6}+\frac{b}{15}=\frac{5a+4b}{30}$

2) $\frac{3}{5x^2b^2a^3}-\frac{5}{7x^5ba^2}=\frac{3\cdot7x^3-5\cdot5ba}{35x^5b^2a^3}=\frac{21x^3-25ab}{35x^5b^2a^3}$

3) $\frac{1}{6a^5x^2b^7y^3}+\frac{1}{15a^3x^4b^5y^3}=\frac{5x^2+2a^2b^2}{30a^5x^4b^7y^3}$

4) $\left(\frac{a}{5x^2}-\frac{2}{10x}\right)\cdot\frac{1}{a-x}=\left(\frac{a}{5x^2}-\frac{1}{5x}\right)\cdot\frac{1}{a-x}$

$=\frac{a-x}{5x^2}\cdot\frac{1}{a-x}=\frac{1}{5x^2}$

5) $\frac{24a^5x^8y^2}{35m^7b^6z^3}:\frac{8a^6x^5y^2}{7m^7b^5z^4}=\frac{\overset{3}{\cancel{24}}\,\cancel{a^5}\,\cancel{x^8}\,\overset{3}{\cancel{y^2}}}{\underset{5}{\cancel{35}}\,\cancel{m^7}\,\cancel{b^6}\,\cancel{z^3}}\cdot\frac{\cancel{7}\,\cancel{m^7}\,\cancel{b^5}\,z^4}{\cancel{8}\,\cancel{a^6}\,\cancel{x^5}\,\cancel{y^2}}$

$=\frac{3x^3z}{5ab}$

6) $\left(\frac{x}{4a^3}+\frac{b}{8a}\right):\frac{2x+a^2b}{4a^2}=\frac{2x+a^2b}{8a^3}\cdot\frac{4a^2}{2x+a^2b}$

$=\frac{4a^2}{8a^3}=\frac{1}{2a}$

7) $\left(\frac{4}{b(x-a)^2}-\frac{1}{b^3(x-a)}\right)\cdot\frac{b^3}{a+4b^2-x}$

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

$=\frac{1}{(x-a)^2}$

8) $\left(\frac{b}{3m^2}-\frac{a}{5m}\right)\cdot\frac{5m^2}{(5b-3am)^2}=\frac{5b-3am}{15m^2}\cdot\frac{5m^2}{(5b-3am)^2}$

$=\frac{1}{3(5b-3am)}=\frac{1}{15b-9am}$

9) $\left(\frac{p}{5m}+\frac{b}{m}\right)\cdot\frac{m}{(p+5b)^3}=\frac{p+5b}{5m}\cdot\frac{m}{(p+5b)^{3\cdot2}}$

$=\frac{1}{5(p+5b)^2}$

10) $\left(\frac{1}{3a^2b^5}+\frac{1}{6a^3b^2}\right):\frac{2a+b^3}{3a^2b^3}=\frac{2a+b^3}{6a^3b^5}\cdot\frac{3a^2b^3}{2a+b^3}$

$=\frac{3a^2b^3}{6a^3b^5}=\frac{1}{2ab^2}$

11) $x+\frac{2b}{3xm^2}=\frac{x\cdot3xm^2}{3xm^2}+\frac{2b}{3xm^2}=\frac{3x^2m^2+2b}{3xm^2}$

12) $\frac{1}{a} + \frac{2}{3a^2} = \frac{3a+2}{3a^2}$

13) $\frac{x}{a^2b} - \frac{1}{ab^3} = \frac{b^2x - a}{a^2b^3}$

14) $\frac{ax^2}{b^3y} : \frac{a^2x}{y^2b} = \frac{ax^2}{b^3y} \cdot \frac{y^2b}{a^2x} = \frac{xy}{ab^2}$

15) $\frac{(x-a)z^2}{b(x-a)^2} : \frac{z}{ab(x-a)} = \frac{z^2}{b(x-a)} \cdot \frac{ab(x-a)}{z} = az$

16) $\frac{a}{x} - \frac{b-2x-x^2}{x} = \frac{a-(b-2x-x^2)}{x} = \frac{a-b+2x+x^2}{x}$

17) $\frac{2bc}{x^4y^5} : \frac{2c^2}{x^6y^3} = \frac{2bc}{x^4y^5} \cdot \frac{x^6y^3}{2c^2} = \frac{bx^2}{cy^2}$

18) $\frac{5x}{3ab^2} = \frac{?}{6a^3b^2mx}$; $6a^3b^2mx : 3ab^2 = 2a^2mx$

$\frac{5x}{3ab^2} = \frac{5x \cdot 2a^2mx}{3ab^2 \cdot 2a^2mx} = \frac{10a^2mx^2}{6a^3b^2mx}$

19) $\frac{3a}{5x(b-am)^2} = \frac{?}{5x^4(b-am)^3}$; $5x^4(b-am)^3 : 5x(b-am)^2 = x^3(b-am)$

$\frac{3a}{5x(b-am)^2} = \frac{3a \cdot x^3(b-am)}{5x(b-am)^2 \cdot x^3(b-am)} = \frac{3ax^3(b-am)}{5x^4(b-am)^3}$