1.10

$$-5 \in \mathbb{Z}$$

$$-5 \notin \mathbb{N}$$

$$\frac{2}{3} \notin \mathbb{Z}$$

$$\frac{2}{3} \in \mathbb{Q}$$

$$\sqrt{5} \in \mathbb{R}$$

$$\sqrt{5} \notin \mathbb{Q}$$

1.11

$$2 \in \{1, 2, 3, 4\}$$

$$3 \notin \{0, 1, 2, 4\}$$

$$1, 5 \notin \{1, 2, 3, 4\}$$

$$-1 \notin \{-2, 1, 0, 1\}$$

1.12

$$\{0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20\}$$

$$\{21, 23, 25, 27, 29, 31, 33, 35\}$$

$$\{2, 3, 5, 7, 11, 13, 17, 19, 23, 29\}$$

1.13

$$\{1, 2, 3, 4\} \backslash \{4\} = \{1, 2, 3\}$$

$$\{1, 2, 3, 4\} \backslash \{2, 4\} = \{1, 3\}$$

$$\{1, 2, 3, 4\} \backslash \{1, 5\} = \{2, 3, 4\}$$

$$\mathbb{Z} \backslash \mathbb{N} = \{..., -4, -3, -2, -1, 0\}$$

1.14

a)

$$\begin{aligned} 4 * 2^2 &= 4 * 4 \\ &= 16 \end{aligned}$$

b)

$$\begin{aligned} 4 * (-2)^2 &= 4 * 4 \\ &= 16 \end{aligned}$$

c)

$$\begin{aligned} 5 - 3^2 &= 5 - 9 \\ &= -4 \end{aligned}$$

d)

$$\begin{aligned} (5 - 3)^2 &= 2^2 \\ &= 4 \end{aligned}$$

e)

$$\begin{aligned} -2^2 + 3^2 - 2 * (-2) &= -4 + 9 + 4 \\ &= 9 \end{aligned}$$

f)

$$\begin{aligned} -(-2)^2 + (-3)^2 - 2^2 &= -(4) + 9 - 4 \\ &= 1 \end{aligned}$$

g)

$$\begin{aligned} (-3)^2 + 5 * (-3) + 6 &= 9 - 15 + 6 \\ &= -5 + 6 \\ &= 0 \end{aligned}$$

Oppgave 1.15

a)

$$\begin{aligned} 2(7 - 5) + 2 &= 2 * 2 + 2 \\ &= 4 + 2 = 6 \end{aligned}$$

b)

$$\begin{aligned} -3(4-12)+2*3^2 &= -3*-8+2*9 \\ &= 24+18 = 42 \end{aligned}$$

c)

$$\begin{aligned} -(8-4)-(3)^2 &= -4-9 \\ &= -13 \end{aligned}$$

d)

$$\begin{aligned} -2^4+3(17-3^2)+(3*4^2-2*5^2) &= -2^4+3*8+(3*4^2-2*5^2) \\ &= -2^4+3(17-3^2)-2 \\ &= -16+24-2 \\ &= 8-2 \\ &= 6 \end{aligned}$$

Oppgave 1.16

a)

$$\begin{aligned} 2(2*2-2)^2 &= 2(4-2)^2 \\ &= 2*4 \\ &= 8 \end{aligned}$$

b)

$$-2^6+(-2)^6 = -64+64 = 0$$

c)

$$\begin{aligned} 4(3-2)^3-3(2-3)^3 &= 4*1-3*(-1) \\ &= 4+3 \\ &= 7 \end{aligned}$$

d)

$$\begin{aligned} 4(2^2-3)^5-3(2^3-3^2)^5 &= 4*1^5-3*(-1)^5 \\ &= 4*1-3*-1 \\ &= 4-(-3) \\ &= 4+3 \\ &= 7 \end{aligned}$$

Oppgave 1.17

a)

$$\begin{aligned} 2(2*2-2)^2 &= 2(4-2)^2 \\ &= 2*4 \\ &= 8 \end{aligned}$$

b)

$$-2^6 + (-2)^6 = -64 + 64 = 0$$

c)

$$\begin{aligned} 4(3-2)^3 - 3(2-3)^3 &= 4*1 - 3*(-1) \\ &= 4+3 \\ &= 7 \end{aligned}$$

d)

$$\begin{aligned} 4(2^2-3)^5 - 3(2^3-3^2)^5 &= 4*1^5 - 3*(-1)^5 \\ &= 4*1 - 3*-1 \\ &= 4-(-3) \\ &= 4+3 \\ &= 7 \end{aligned}$$

Oppgave 1.20

a)

$$\begin{aligned} \frac{4}{6} &= \frac{4:2}{6:2} \\ &= \frac{2}{3} \end{aligned}$$

b)

$$\begin{aligned} \frac{9}{15} &= \frac{9:3}{15:3} \\ &= \frac{3}{5} \end{aligned}$$

c)

$$\begin{aligned} \frac{18}{21} &= \frac{18:3}{21:3} \\ &= \frac{6}{7} \end{aligned}$$

d)

$$\begin{aligned}\frac{42}{54} &= \frac{42:6}{54:6} \\ &= \frac{7}{9}\end{aligned}$$

Oppgave 1.21

a)

$$\begin{aligned}\frac{72}{120} &= \frac{72:8}{120:8} \\ &= \frac{9}{15} \\ &= \frac{9:3}{15:3} \\ &= \frac{3}{5}\end{aligned}$$

b)

$$\begin{aligned}\frac{126}{294} &= \frac{126:7}{294:7} \\ &= \frac{18:2}{42:2} \\ &= \frac{9:3}{21:3} \\ &= \frac{3}{7}\end{aligned}$$

c)

$$\begin{aligned}\frac{132}{198} &= \frac{132:2}{198:2} \\ &= \frac{66:3}{99:3} \\ &= \frac{22:11}{33:11} \\ &= \frac{2}{3}\end{aligned}$$

d)

$$\begin{aligned}\frac{153}{51} &= \frac{153:3}{51:3}\\ &= \frac{51}{17}\end{aligned}$$

exmaples

$$\begin{aligned}3*\frac{2}{3} &= \frac{3}{1}*\frac{3}{3}-\frac{2}{3}\\ &= \frac{7}{3} = \frac{3+3+1}{3}\\ &= \frac{3}{3}+\frac{3}{3}+\frac{1}{3}\\ &= 1+1+\frac{1}{3} = 2\frac{1}{3}\end{aligned}$$

1.22

$$\begin{aligned}\frac{1}{12}+\frac{4}{9} &= \frac{9}{9}*\frac{1}{12}+\frac{4}{9}*\frac{12}{12}\\ &= \frac{9}{108}+\frac{48}{108}\\ &= \frac{57:3}{108:3}\\ &= \frac{19}{36}\end{aligned}$$

$$\begin{aligned}\frac{1}{12}*\frac{4}{9} &= \frac{4:2}{108:2}\\ &= \frac{2:2}{54:2}\\ &= \frac{1}{27}\end{aligned}$$

$$\begin{aligned}\frac{1}{12}:\frac{4}{9} &= \frac{1}{12}*\frac{9}{4}\\ &= \frac{9:3}{48:3}\\ &= \frac{3}{16}\end{aligned}$$

$$
\begin{aligned}
3 + \frac{5}{12} &= \frac{3 * 12}{1 * 12} + \frac{5}{12} \\
&= \frac{36}{12} + \frac{5}{12} \\
&= \frac{41}{12}
\end{aligned}
$$

$$
\begin{aligned}
3 * \frac{5}{12} &= \frac{3}{1} * \frac{5}{12} \\
&= \frac{15 : 3}{12 : 3} \\
&= \frac{5}{4}
\end{aligned}
$$

$$
\begin{aligned}
3 : \frac{5}{12} &= \frac{3}{1} : \frac{5}{12} \\
&= \frac{3}{1} * \frac{12}{5} \\
&= \frac{36}{5}
\end{aligned}
$$

1.23

$$
\begin{aligned}
2 * \left(\frac{3}{8} + \frac{1}{4}\right) &= 2 * \left(\frac{4}{4} * \frac{3}{8} + \frac{1}{4} * \frac{8}{8}\right) \\
&= 2 * \left(\frac{12}{32} + \frac{8}{32}\right) \\
&= 2 * \frac{20}{32} \\
&= \frac{2 * 20}{32} \\
&= \frac{40 : 2}{32 : 2} \\
&= \frac{20 : 2}{16 : 2} \\
&= \frac{10 : 2}{8 : 2} \\
&= \frac{5}{4}
\end{aligned}
$$

$$\begin{aligned}\left(\frac{5}{6}-\frac{2}{9}\right)*\frac{3}{5} &= \left(\frac{5*3}{6*3}-\frac{2*2}{9*2}\right)*\frac{3}{5}\\ &= \left(\frac{15}{18}-\frac{4}{18}\right)*\frac{3}{5}\\ &= \frac{11}{18}*\frac{3}{5}\\ &= \frac{33:3}{90:3}\\ &= \frac{11}{30}\end{aligned}$$

$$\begin{aligned}\left(\frac{5}{36}+\frac{1}{12}\right):\frac{2}{9} &= \left(\frac{5}{36}+\frac{1*3}{12*3}\right):\frac{2}{9}\\ &= \left(\frac{5}{36}+\frac{3}{36}\right):\frac{2}{9}\\ &= \frac{8}{36}*\frac{9}{2}\\ &= \frac{72}{72}\\ &= 1\end{aligned}$$

1.24

$$\frac{\frac{2}{3}}{\frac{5}{6}} = \frac{\frac{2}{3}*\frac{6}{1}}{\frac{5}{6}*\frac{6}{1}}$$

$$\frac{\frac{21}{36}}{\frac{14}{45}}$$

$$\frac{\frac{3}{2}+\frac{5}{8}}{\frac{1}{4}+\frac{25}{2}}$$

$$\frac{3+\frac{4}{3}}{\frac{5}{12}+5}$$

1.30

$$2x - 5y + 3x + 7y + 1 = 5x + 2y + 1$$

$$a^2 + 2a + 3 + a^2 - 3a - 1 = 2a^2 - a + 2$$

$$2x^2 + x + y^2 - 2x - 2y^2 = 2x^2 - x - y^2$$

$$2xy + xy^2 - x^2y - 2xy^2 - yx = xy - xy^2 - x^2y$$

1.31

$$\begin{aligned}(5x + y) + (2x - y) &= 5x + y + 2x - y \\ &= 7x\end{aligned}$$

$$\begin{aligned}a + 2b - (-a + b) &= a + 2b + a - b \\ &= 2a + b\end{aligned}$$

$$\begin{aligned}(x^2 + 2x + 1) - (x^2 - 2x + 1) &= x^2 + 2x + 1 - x^2 + 2x - 1 \\ &= 4x1 - 1 \\ &= 4x\end{aligned}$$

$$\begin{aligned}2a^2 - a - 3 + (-a^2 + a + 3) &= 2a^2 - a - 3 - a^2 + a + 3 \\ &= a^2\end{aligned}$$

1.32

$$\begin{aligned}2(x + 4) &= 2 * x + 2 * 4 \\ &= 2x + 8\end{aligned}$$

$$\begin{aligned}-2(t - 3) &= -2 * t - (-2 * 3) \\ &= -2t + 6\end{aligned}$$

$$\begin{aligned}3(2x + 1) - 2(3x + 1) &= 3 * 2x + 3 * 1 - 2 * 3x - 2 * 1 \\ &= 6x + 3 - 6x - 2 \\ &= 3 - 2 \\ &= 1\end{aligned}$$

$$\begin{aligned}5(x^2 + 3x + 2) - 5(x^2 + 1) &= 5x^2 + 15x + 10 - 5x^2 - 5 \\ &= 15x + 10 - 5 \\ &= 15x + 5\end{aligned}$$

1.33

$$\begin{aligned} 2(2a-b)+3(-2a+3b) &= 4a-2b-6a+9b \\ &= -2a+7b \end{aligned}$$

$$\begin{aligned} 2a(ab-b^2)-2b(a^2-ab) &= 2ba^2-2ab^2-2ba^2+2ab^2 \\ &= 2ba^2-2ba^2+2ab^2-2ab^2 \\ &= 0 \end{aligned}$$

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

$$\begin{aligned} 5(x^2+3x+2)-5(x^2+1) &= 5x^2+15x+10-5x^2-5 \\ &= 15x+10-5 \\ &= 15x+5 \end{aligned}$$

1.40

$$\begin{aligned} \frac{a}{2}+\frac{a}{3}+\frac{a}{6} &= \frac{a}{2*3}+\frac{a}{3*2}+\frac{a}{6} \\ &= \frac{a}{6}+\frac{a}{6}+\frac{a}{6} \\ &= \frac{x}{y} \end{aligned}$$

$$\begin{aligned} 2a(ab-b^2)-2b(a^2-ab) &= 2ba^2-2ab^2-2ba^2+2ab^2 \\ &= 2ba^2-2ba^2+2ab^2-2ab^2 \\ &= 0 \end{aligned}$$

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

$$\begin{aligned} 5(x^2+3x+2)-5(x^2+1) &= 5x^2+15x+10-5x^2-5 \\ &= 15x+10-5 \\ &= 15x+5 \end{aligned}$$