

# Arbeidshefte

## Rasjonale likninger

### Løsningsforslag

#### Oppgave 1

1)

$$\begin{aligned}\frac{2}{x} &= \frac{6}{30} \\ \frac{2}{x} &= \frac{1}{5} \\ 2 \cdot 5 &= 1 \cdot x \\ x &= 10\end{aligned}$$

2)

$$\begin{aligned}\frac{x}{15} &= \frac{5}{75} \\ \frac{x}{15} &= \frac{1}{15} \\ x &= 1\end{aligned}$$

3)

$$\begin{aligned}\frac{x}{20} &= \frac{2}{10} \\ \frac{x}{2} &= \frac{2}{1} \\ x &= 2 \cdot 2 \\ x &= 4\end{aligned}$$

4)

$$\begin{aligned}\frac{x}{5} &= \frac{12}{6} \\ \frac{x}{5} &= 2 \\ x &= 10\end{aligned}$$

5)

$$\begin{aligned}\frac{x}{30} &= \frac{7}{10} \\ \frac{x}{3} &= \frac{7}{1} \\ x &= 7 \cdot 3 \\ x &= 21\end{aligned}$$

6)

$$\begin{aligned}\frac{2}{17} &= \frac{x-6}{x+9} \\ 2(x+9) &= 17(x-6) \\ 2x+18 &= 17x-102 \\ 2x-17x &= -102-18 \\ 15x &= 120 \\ x &= 8\end{aligned}$$

## Oppgave 2

1)

$$\frac{5}{15} = \frac{x}{9}$$

2)

$$\frac{x+1}{7} = \frac{6}{14}$$

3)

$$\frac{x+1}{x+5} = \frac{5}{9}$$

## Oppgave 3

1)

$$\begin{aligned}\frac{x-2}{16} &= \frac{x}{4} \\ \frac{x-2}{4} &= x \\ x-2 &= 4x \\ 3x &= -2 \\ x &= -\frac{2}{3}\end{aligned}$$

2)

$$\begin{aligned}\frac{x}{6} &= \frac{x-3}{12} \\ 2x &= x-3 \\ x &= -3\end{aligned}$$

3)

$$\begin{aligned}\frac{2x}{10} &= \frac{5}{2} \\ \frac{2x}{5} &= 5 \\ 2x &= 25 \\ x &= \frac{25}{2}\end{aligned}$$

## Oppgave 4

1)

$$\begin{aligned}\frac{x}{3} &= \frac{12}{27} \\ \frac{x}{3} &= \frac{4}{9} \\ x &= \frac{4}{3}\end{aligned}$$

2)

$$\begin{aligned}\frac{6}{x+5} &= \frac{18}{24} \\ \frac{6}{x+5} &= \frac{3}{4} \\ 6 \cdot 4 &= 3 \cdot (x+5) \\ 24 &= 3x + 15 \\ 3x &= 9 \\ x &= 3\end{aligned}$$

3)

$$\begin{aligned}\frac{5+x}{10} &= \frac{2}{5} \\ \frac{5+x}{2} &= 2 \\ 5+x &= 4 \\ x &= -1\end{aligned}$$

## Oppgave 5

1)

$$\begin{aligned}\frac{x-4}{30} &= \frac{1}{5} \\ \frac{x-4}{6} &= 1 \\ x-4 &= 6 \\ x &= 10\end{aligned}$$

2)

$$\begin{aligned}\frac{x-5}{x-1} &= \frac{1}{5} \\ 5(x-5) &= x-1 \\ 5x-25 &= x-1 \\ 4x &= 24 \\ x &= 6\end{aligned}$$

## Oppgave 6

1)

$$\begin{aligned}\frac{x-2}{x+6} &= \frac{1}{9} \\ 9(x-2) &= x+6 \\ 9x-18 &= x+6 \\ 8x &= 24 \\ x &= 3\end{aligned}$$

3)

$$\begin{aligned}\frac{x+2}{x+7} &= \frac{7}{12} \\ 12(x+2) &= 7(x+7) \\ 12x+24 &= 7x+49 \\ 5x &= 25 \\ x &= 5\end{aligned}$$

2)

$$\begin{aligned}\frac{4}{x-3} &= \frac{28}{49} \\ \frac{4}{x-3} &= \frac{4}{7} \\ \frac{1}{x-3} &= \frac{1}{7} \\ x-3 &= 7 \\ x &= 10\end{aligned}$$

4)

$$\begin{aligned}\frac{x+7}{x-9} &= \frac{28}{12} \\ \frac{x+7}{x-9} &= \frac{7}{3} \\ 3(x+7) &= 7(x-9) \\ 3x+21 &= 7x-63 \\ 4x &= 84 \\ x &= 21\end{aligned}$$

## Oppgave 7

1)

$$\begin{aligned}\frac{6}{x} - \frac{2}{8} &= \frac{x}{8} \\ 48 - 2x - x^2 &= 0 \\ (x+8)(x-6) &= 0 \\ x &= -8 \vee x = 6\end{aligned}$$

3)

$$\begin{aligned}3 - \frac{9}{x} &= 30 \\ 3x - 9 &= 30x \\ 27x^2 &= 9 \\ x &= -\frac{9}{27} \\ x &= -\frac{1}{3}\end{aligned}$$

2)

$$\begin{aligned}\frac{x}{2} + \frac{5}{6} &= \frac{x}{3} \\ 3x + 5 &= 2x \\ x &= -5\end{aligned}$$

## Oppgave 8

1)

$$\begin{aligned}17 - \frac{3}{x} &= 8 \\ \frac{3}{x} &= 9 \\ 9x &= 3 \\ x &= \frac{3}{9} \\ x &= \frac{1}{3}\end{aligned}$$

2)

$$\begin{aligned}1 - \frac{4}{x} &= 5 \\ \frac{4}{x} &= -4 \\ -4x &= 4 \\ x &= -1\end{aligned}$$

3)

$$\begin{aligned}\frac{3x + 4}{2x - 1} &= 1 \\ 3x + 4 &= 2x - 1 \\ x &= -5\end{aligned}$$

4)

$$\begin{aligned}\frac{5x + 4}{3x + 4} &= \frac{3}{2} \\ 2(5x + 4) &= 3(3x + 4) \\ 10x + 8 &= 9x + 12 \\ x &= 4\end{aligned}$$

## Oppgave 9 \*

1)

$$\begin{aligned}\frac{2x+1}{x+1} + \frac{3}{x} &= \frac{9}{2} \\ 2x(2x+1) + 6(x+1) &= 9x(x+1) \\ 4x^2 + 2x + 6x + 6 &= 9x^2 + 9x \\ 5x^2 + x - 6 &= 0 \\ x = 1 \vee x &= -\frac{6}{5}\end{aligned}$$

2)

$$\begin{aligned}\frac{3x+5}{2x-1} - 4 &= \frac{4}{x} \\ x(3x+5) - 4x(2x-1) &= 4(2x-1) \\ 3x^2 + 5x - 8x^2 + 4x &= 8x - 4 \\ -5x^2 - x + 4 &= 0 \\ x &= \frac{1 \pm \sqrt{(-1)^2 - 4 \cdot (-5) \cdot 4}}{2 \cdot (-5)} \\ x = -1 \vee x &= \frac{4}{5}\end{aligned}$$

3)

$$\begin{aligned}\frac{1}{2} - \frac{2}{x-1} &= \frac{-4}{x^2-1} \\ (x+1)(x-1) - 4(x+1) &= -8 \\ x^2 - 1 - 4x - 4 + 8 &= 0 \\ x^2 - 4x + 3 &= 0 \\ (x-3)(x-1) &= 0 \\ x = 3 \vee x &= 1\end{aligned}$$

NB!!  $x=1$  er IKKE gyldig løsning fordi det gir null i nevner

4)

$$\begin{aligned}\frac{-2}{x^2-2x} - \frac{1}{x} &= \frac{x}{x-2} \\ -2 - (x-2) &= x^2 \\ -2 - x + 2 - x^2 &= 0 \\ x^2 + x &= 0 \\ x(x+1) &= 0 \\ x = 0 \vee x &= -1\end{aligned}$$

$x=0$  er IKKE gyldig løsning

## Oppgave 10

1)

$$\begin{aligned}\frac{2x-5}{x-1} &= 0 \\ 2x-5 &= 0 \\ 2x &= 5 \\ x &= \frac{5}{2}\end{aligned}$$

2)

$$\begin{aligned}\frac{3x+6}{x-2} &= 2 \\ 3x+6 &= 2(x-2) \\ 3x+6 &= 2x-4 \\ x &= -10\end{aligned}$$

3)

$$\begin{aligned}\frac{x+2}{x+1} &= -3 \\ x+2 &= -3(x+1) \\ x+2 &= -3x-3 \\ 4x &= -5 \\ x &= -\frac{5}{4}\end{aligned}$$

4)

$$\begin{aligned}x &= \frac{6}{x+5} \\ x(x+5) &= 6 \\ x^2+5x-6 &= 0 \\ (x+6)(x-1) &= 0 \\ x &= -6 \vee x = 1\end{aligned}$$

## Oppgave 11

1)

$$\begin{aligned}\frac{2}{x-2} + \frac{3}{x} &= 3 \\ 2x + 3(x-2) &= 3x(x-2) \\ 2x + 3x - 6 &= 3x^2 - 6x \\ 3x^2 - 11x + 6 &= 0 \\ x &= \frac{-(-11) \pm \sqrt{(-11)^2 - 4 \cdot 3 \cdot 6}}{2 \cdot 3} \\ x &= \frac{11 \pm \sqrt{121 - 72}}{6} \\ x &= \frac{11 \pm \sqrt{49}}{6} \\ x &= \frac{11 \pm 7}{6} \\ x &= 3 \vee x = \frac{2}{3}\end{aligned}$$

2)

$$\begin{aligned}\frac{3x+2}{x+2} - \frac{x}{x-2} &= 2 \\ (3x+2)(x-2) - x(x+2) &= 2(x+2)(x-2) \\ 3x^2 - 6x + 2x - 4 - x^2 - 2x &= 2x^2 - 8 \\ -6x + 4 &= 0 \\ 2(x-3) &= 0 \\ x &= 1\end{aligned}$$

3)

$$\begin{aligned}\frac{x^2 - 2x - 3}{x^2 - 16} &= 0 \\ (x-3)(x+1) &= 0 \\ x &= 3 \vee x = -1\end{aligned}$$

4)

$$\begin{aligned}\frac{x}{x-3} - \frac{2}{x-1} &= \frac{4}{x^2 - 4x + 3} \\ x(x-1) - 2(x-3) &= 4 \\ x^2 - x - 2x + 6 - 4 &= 0 \\ x^2 - 3x + 2 &= 0 \\ (x-2)(x-1) &= 0 \\ x &= 2 \vee x = 1\end{aligned}$$

$x=1$  er IKKE et gyldig svar.