

$$1. \quad \frac{1}{f} = \frac{1}{g} + \frac{1}{b} = \frac{1}{20 \text{ cm}} + \frac{1}{5 \text{ cm}} = 0.05 \frac{1}{\text{cm}} + 0.2 \frac{1}{\text{cm}} = 0.25 \frac{1}{\text{cm}} \Rightarrow f = \frac{1}{0.25} \text{ cm} = \underline{\underline{4 \text{ cm}}}$$

oder:

$$\frac{1}{f} = \frac{1}{g} + \frac{1}{b} = \frac{1}{20 \text{ cm}} + \frac{1}{5 \text{ cm}} = \frac{1}{20 \text{ cm}} + \frac{4}{20 \text{ cm}} = \frac{1+4}{20 \text{ cm}} = \frac{5}{20 \text{ cm}} \Rightarrow f = \frac{20 \text{ cm}}{5} = \underline{\underline{4 \text{ cm}}}$$

f ist positiv, es handelt sich also um eine Konvexlinse.

$$2. \quad \frac{1}{b} = \frac{1}{f} - \frac{1}{g} = 0.1 \frac{1}{\text{cm}} - 0.02 \frac{1}{\text{cm}} = 0.08 \frac{1}{\text{cm}} \Rightarrow b = \frac{1}{0.08} \text{ cm} = \underline{\underline{12.5 \text{ cm}}}$$

oder:

$$\frac{1}{b} = \frac{1}{f} - \frac{1}{g} = \frac{1}{10 \text{ cm}} - \frac{1}{50 \text{ cm}} = \frac{5}{50 \text{ cm}} - \frac{1}{50 \text{ cm}} = \frac{4}{50 \text{ cm}} \Rightarrow b = \frac{50 \text{ cm}}{4} = \underline{\underline{12.5 \text{ cm}}}$$

b ist positiv, das Bild ist also reell.

$$3. \quad \frac{1}{b} = \frac{1}{f} - \frac{1}{g} = \frac{1}{5 \text{ cm}} - \frac{1}{1 \text{ cm}} = 0.2 \frac{1}{\text{cm}} - 1 \frac{1}{\text{cm}} = -0.8 \frac{1}{\text{cm}} \Rightarrow b = -\frac{1}{0.8} \text{ cm} = \underline{\underline{-1.25 \text{ cm}}}$$

oder:

$$\frac{1}{b} = \frac{1}{f} - \frac{1}{g} = \frac{1}{5 \text{ cm}} - \frac{1}{1 \text{ cm}} = \frac{1}{5 \text{ cm}} - \frac{5}{5 \text{ cm}} = -\frac{4}{5 \text{ cm}} \Rightarrow b = -\frac{5 \text{ cm}}{4} = \underline{\underline{-1.25 \text{ cm}}}$$

b ist negativ, das Bild ist also virtuell.

$$4. \quad \frac{1}{f} = \frac{1}{g} + \frac{1}{b} = \frac{1}{4.5 \text{ cm}} + \frac{1}{-6.5 \text{ cm}} = 0.2222 \frac{1}{\text{cm}} - 0.1538 \frac{1}{\text{cm}} = 0.0684 \frac{1}{\text{cm}}$$

$$\Rightarrow f = \frac{1}{0.0684} \text{ cm} = \underline{\underline{14.6 \text{ cm}}}$$

oder:

$$\frac{1}{f} = \frac{1}{g} + \frac{1}{b} = \frac{1}{4.5 \text{ cm}} + \frac{1}{-6.5 \text{ cm}} = \frac{1}{45 \text{ mm}} - \frac{1}{65 \text{ mm}} = \frac{13}{585 \text{ mm}} - \frac{9}{585 \text{ mm}} = \frac{4}{585 \text{ mm}}$$

$$\Rightarrow f = \frac{58.5 \text{ cm}}{4} = \underline{\underline{14.6 \text{ cm}}}$$

f ist positiv, es handelt sich also um eine Konvexlinse.

b ist negativ, das Bild ist also virtuell.

$$5. \quad \frac{1}{f} = \frac{1}{g} + \frac{1}{b} = \frac{1}{7.5 \text{ cm}} + \frac{1}{-4.5 \text{ cm}} = 0.1333 \frac{1}{\text{cm}} - 0.2222 \frac{1}{\text{cm}} = -0.0889 \frac{1}{\text{cm}}$$

$$\Rightarrow f = -\frac{1}{0.0889} \text{ cm} = \underline{\underline{-11.25 \text{ cm}}}$$

oder:

$$\frac{1}{f} = \frac{1}{g} + \frac{1}{b} = \frac{1}{7.5 \text{ cm}} + \frac{1}{-4.5 \text{ cm}} = \frac{3}{225 \text{ mm}} - \frac{5}{225 \text{ mm}} = -\frac{2}{225 \text{ mm}}$$

$$\Rightarrow f = -\frac{22.5 \text{ cm}}{2} = \underline{\underline{-11.25 \text{ cm}}}$$

f ist negativ, es handelt sich also um eine Konkavlinse.

b ist negativ, das Bild ist also virtuell.

$$6. \quad a) \quad \frac{1}{b} = \frac{1}{f} - \frac{1}{g} = \frac{1}{12 \text{ cm}} - \frac{1}{240 \text{ cm}} = 0.083333 \frac{1}{\text{cm}} - 0.004167 \frac{1}{\text{cm}} = 0.079167 \frac{1}{\text{cm}}$$

$$\Rightarrow b = \frac{1}{0.079167} \text{ cm} = \underline{\underline{12.6 \text{ cm}}}$$

oder:

$$\frac{1}{b} = \frac{1}{f} - \frac{1}{g} = \frac{1}{12 \text{ cm}} - \frac{1}{240 \text{ cm}} = \frac{20}{240 \text{ cm}} - \frac{1}{240 \text{ cm}} = \frac{19}{240 \text{ cm}} \Rightarrow b = \frac{240 \text{ cm}}{19} = \underline{\underline{12.6 \text{ cm}}}$$

$$b) \quad B = \frac{b \cdot G}{g} = \frac{12.6 \text{ cm} \cdot 160 \text{ cm}}{240 \text{ cm}} = \underline{\underline{8.4 \text{ cm}}}$$

$$7. \quad a) \quad \frac{1}{f} = \frac{1}{g} + \frac{1}{b} = \frac{1}{5'000 \text{ mm}} + \frac{1}{24 \text{ mm}} = 0.00020 \frac{1}{\text{mm}} + 0.04167 \frac{1}{\text{mm}} = 0.04187 \frac{1}{\text{mm}}$$

$$\Rightarrow f = \frac{1}{0.04187} \text{ mm} = \underline{\underline{23.9 \text{ mm}}}$$

oder:

$$\frac{1}{f} = \frac{1}{g} + \frac{1}{b} = \frac{3}{15'000 \text{ mm}} + \frac{625}{15'000 \text{ mm}} = \frac{628}{15'000 \text{ mm}} \Rightarrow f = \frac{15'000 \text{ mm}}{628} = \underline{\underline{23.9 \text{ mm}}}$$

$$b) \quad B = \frac{b \cdot G}{g} = \frac{24 \text{ mm} \cdot 1'800 \text{ mm}}{5'000 \text{ mm}} = \underline{\underline{8.64 \text{ mm}}}$$