# Lösungen

## 1

```
100 x - x
```

$$99\,x$$

```
x = 145.279787878787878787878787878787878787878787878;
y = 100 x - x
```

$$14382.699000000000000000000000000000000000000000$$

```
z = y // Chop// Rationalize;  z
```

$$\frac{14382699}{1000}$$

```
Clear[x];
Solve[100 x - x == z, {x}] // Flatten
```

$$\left\{x \to \frac{4794233}{33000}\right\}$$

```
N[4794233/33000, 200]
```

$$145.27978787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787878787879$$

```
Remove["Global`*"]
```

## 2

```
? Log
```

```
Log[z] gives the natural logarithm of z (
   logarithm to base e). Log[b, z] gives the logarithm to base b. Mehr...
```

```
Log[5, 10^(Log[5, c])] Log[5, 100] / Log[5, c] +
  Log[x, x / x^(Log[5, c]) c^(Log[5, x])] // Simplify
```

$$1 + \frac{\text{Log}[100]\,\text{Log}\left[10^{\frac{\text{Log}[c]}{\text{Log}[5]}}\right]}{\text{Log}[5]\,\text{Log}[c]}$$

```
(Log[5,10^(Log[5,c])] Log[5,100] / Log[5,c] + Log[x,x/x^(Log[5,c])
c^(Log[5,x])]//Simplify)/. Log[10^(Log[c]/Log[5])]-> (Log[c]/Log[5]) Log[10]
```

$$1 + \frac{\text{Log}[10]\,\text{Log}[100]}{\text{Log}[5]^2}$$

```
((Log[5, 10^(Log[5, c])] Log[5, 100] / Log[5, c] +
      Log[x, x / x^(Log[5, c]) c^(Log[5, x])] // Simplify) /.
   Log[10^(Log[c] / Log[5])] → (Log[c] / Log[5]) Log[10]) /. Log[100] → 2 Log[10]
```

$$1 + \frac{2\,\text{Log}[10]^2}{\text{Log}[5]^2}$$

```
(((Log[5, 10^(Log[5, c])] Log[5, 100] / Log[5, c] +
        Log[x, x / x^(Log[5, c]) c^(Log[5, x])] // Simplify) /.
     Log[10^(Log[c] / Log[5])] → (Log[c] / Log[5]) Log[10]) /.
   Log[100] → 2 Log[10]) /. Log[10] → (Log[2] + Log[5])
```

$$1 + \frac{2\,(\text{Log}[2] + \text{Log}[5])^2}{\text{Log}[5]^2}$$

```
%//N
```

```
5.09367
```

```
Remove["Global`*"]
```

---

# 3

```
Lg[x_]:=Log[5,x]; Lg[25]
```

```
2
```

```
Solve[(1-Lg[Lg[x]])(Lg[Lg[x]]+1)==0,{x}]
```

$$\{\{x \to 3125\}, \{x \to 5^{1/5}\}\}$$

```
N[%]
```

$$\{\{x \to 3125.\}, \{x \to 1.37973\}\}$$

```
FactorInteger[3125]
```

$$\{\{5, 5\}\}$$

```
Remove["Global`*"]
```

---

# 4

```
Lg[x_]:=Log[2,x];
```

```
Solve[{8 == y^(Lg[Sqrt[x]]), Lg[x+2]+Lg[x-5] == Lg[x+5]+Lg[2-x]}, {x,y}]
```

$$\left\{\left\{x \to \sqrt{10},\ y \to e^{\frac{4\,\text{Log}[2]\,\text{Log}[8]}{\text{Log}[10]}}\right\}\right\}$$

```
% // N
```

$$\{\{x \to 3.16228,\ y \to 12.2301\}\}$$

```
2 - 3.16228
```

```
-1.16228
```

```
Remove["Global`*"]
```

Lösung nicht zulässig, da Lg[2-x] = Lg[-1.16228] im Reellen nicht existiert.

---

# 5

```
Ln[x_]:=Log[x];
```

```
Ln[x^6]+6 /. {Log[x^6]->6 Log[x]}
```

$$6 + 6\,\text{Log}[x]$$

```
solv=Solve[(Ln[x]^3+(Ln[x^6])/6==-6 Ln[x] /. {Log[x^6]->6 Log[x]}),
{Log[x]}]//Flatten
```

$$\left\{\text{Log}[x] \to 0,\ \text{Log}[x] \to -i\sqrt{7},\ \text{Log}[x] \to i\sqrt{7}\right\}$$

```
Solve[Log[x] == 0, {x}]
```

$$\{\{x \to 1\}\}$$

Vergleich:

```
solv = Solve[
   (Ln[x]^3 - (Ln[x^6])^2 / 6 == -6 Ln[x] /. {Log[x^6] → 6 Log[x]}), {Log[x]}] // Flatten
```

$$\left\{\text{Log}[x] \to 0,\ \text{Log}[x] \to 3 - \sqrt{3},\ \text{Log}[x] \to 3 + \sqrt{3}\right\}$$

```
% // N
```

$$\{\text{Log}[x] \to 0.,\ \text{Log}[x] \to 1.26795,\ \text{Log}[x] \to 4.73205\}$$

```
solv[[1]]
```

$$\text{Log}[x] \to 0$$

```
E^0
```

$$1$$

```
(Hold[E^Log[x]] /. solv[[2]])[[1]]
```

$$e^{3-\sqrt{3}}$$

```
% // N
```

$$3.55356$$

```
(Hold[E^Log[x]] /. solv[[3]])[[1]]
```

$$e^{3+\sqrt{3}}$$

```
% // N
```

```
113.528
```

```
Remove["Global`*"]
```

---

# 6

```
Solve[2^(3(x-1)) 3^(2x) 5^(1+2x) == 4^(6-3x),{x}]
```

```
{}
```

Direkte Berechnung der Lösung erfolglos.

```
2^(3 (x - 1)) 3^(2 x) 5^(1 + 2 x) - 4^(6 - 3 x) // Simplify
```

$$-8^{4-2x} + 5^{1+2x}\, 8^{-1+x}\, 9^{x}$$

```
(E^Log[2])^(3 (x - 1)) (E^Log[3])^(2 x) (E^Log[5])^(1 + 2 x) -
  (E^Log[4])^(6 - 3 x) // Simplify
```

$$-8^{4-2x} + 5^{1+2x}\, 8^{-1+x}\, 9^{x}$$

```
Solve[E^(Log[2] 3 (x - 1) + Log[3] 2 x + Log[5] (1 + 2 x)) == E^(Log[4] (6 - 3 x)), {x}] //
 Simplify
```

$$\left\{\left\{x \to \frac{\text{Log}\left[\frac{32768}{5}\right]}{\text{Log}[115200]}\right\}\right\}$$

```
2^15
```

```
32768
```

```
FactorInteger[115200]
```

```
{{2, 9}, {3, 2}, {5, 2}}
```

```
2^9 3^2 5^2
```

```
115200
```

```
N[%]
```

```
115200.
```

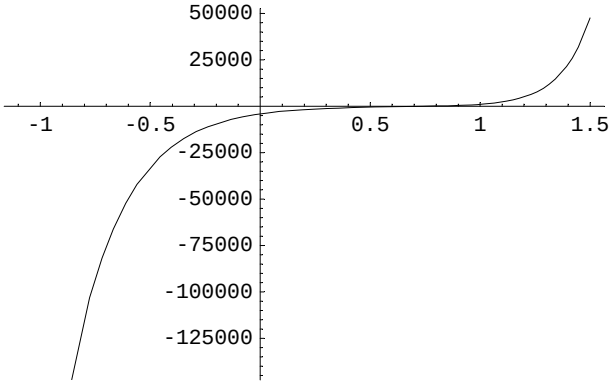
```
Solve[(Log[2] 3 (x - 1) + Log[3] 2 x + Log[5] (1 + 2 x)) == (Log[4] (6 - 3 x)), {x}] // Simplify
```

$$\left\{\left\{x \to \frac{\text{Log}\left[\frac{32768}{5}\right]}{\text{Log}[115200]}\right\}\right\}$$

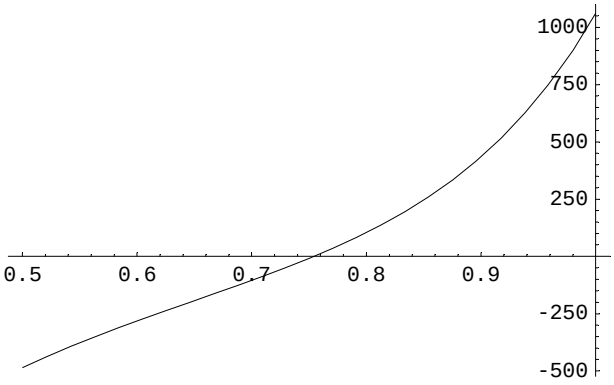
```
N[%]
```

```
{{x → 0.754029}}
```

```
Plot[2^(3 (x - 1)) 3^(2 x) 5^(1 + 2 x) - 4^(6 - 3 x), {x, -1.1, 1.5}];
```




```
Plot[2^(3 (x - 1)) 3^(2 x) 5^(1 + 2 x) - 4^(6 - 3 x), {x, 0.5, 1}];
```




```
Remove["Global`*"]
```

## 7

```
Solve[9+8 u+8 u x +9 x^2==0, {x}]
```

$$\left\{\left\{x \to \frac{1}{9}\left(-4\,u - \sqrt{-81 - 72\,u + 16\,u^2}\right)\right\}, \left\{x \to \frac{1}{9}\left(-4\,u + \sqrt{-81 - 72\,u + 16\,u^2}\right)\right\}\right\}$$

```
Solve[-81 - 72 u + 16 u^2 == 0, {u}]
```

$$\left\{\left\{u \to \frac{9}{4}\left(1 - \sqrt{2}\right)\right\}, \left\{u \to \frac{9}{4}\left(1 + \sqrt{2}\right)\right\}\right\}$$

```
% // N
```

$$\{\{u \to -0.931981\}, \{u \to 5.43198\}\}$$

```
Remove["Global`*"]
```

## 8

```
Solve[(Sqrt[x^2+4]+6x+2)/Sqrt[(x+2)]==0,{x}]
```

$$\left\{\left\{x \to -\frac{24}{35}\right\}\right\}$$

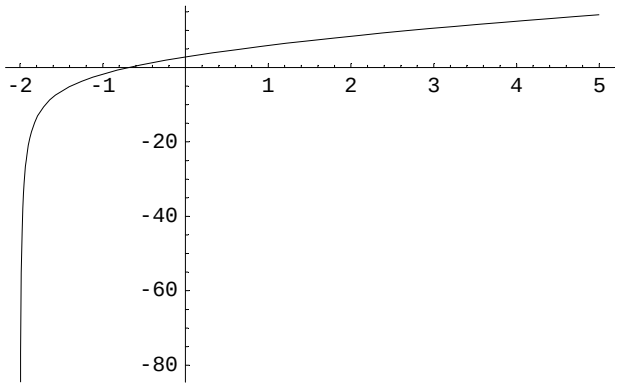
```
Solve[(Sqrt[x^2+4]+6x+2)==0,{x}]
```

$$\left\{\left\{x \to -\frac{24}{35}\right\}\right\}$$

```
N[%]
```

```
{{x → -0.685714}}
```

```
Plot[(Sqrt[x^2+4]+6x+2)/Sqrt[(x+2)],{x,-2,5}];
```




```
Remove["Global`*"]
```

## 9

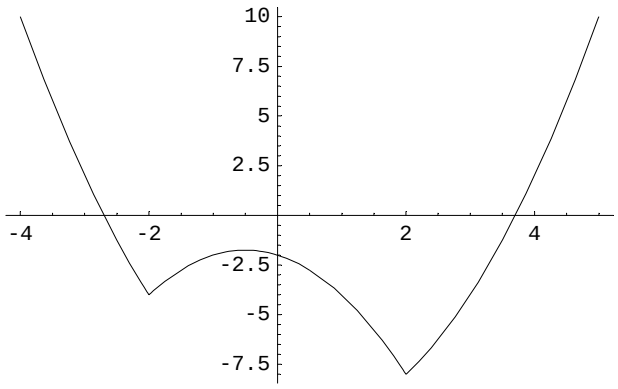
```
Solve[Abs[s-2] Abs[s+2]==6+s,{s}]
```

$$\left\{\left\{s \to \frac{1}{2}\left(1-\sqrt{41}\right)\right\}, \left\{s \to \frac{1}{2}\left(1+\sqrt{41}\right)\right\}\right\}$$

```
% // N
```

```
{{s → -2.70156}, {s → 3.70156}}
```

```
Plot[Abs[s - 2] Abs[s + 2] - 6 - s, {s, -4, 5}];
```




```
Remove["Global`*"]
```

## 10

```
Solve[{
4x+2y-5z==0,
2x-3y==6,
32x-24y-15 z==8},{x,y,z}] // Flatten
```

```
{}
```

```
Solve[{4 x + 2 y - 5 z == 0, 2 x - 3 y == 6, 32 x - 24 y - 16 z == 8}, {x, y, z}] // Flatten
```

$$\left\{x \to \frac{99}{2},\ y \to 31,\ z \to 52\right\}$$

```
% // N
```

```
{x → 49.5, y → 31., z → 52.}
```

```
Remove["Global`*"]
```

## 11

M = { }