In[176]:=
```
newton[t_] = 1 / 2 * (t + 2 / t)
```
Out[176]=
$$\frac{1}{2}\left(\frac{2}{t}+t\right)$$

In[198]:=
```
y = 2
```
Out[198]=
$$2$$

In[199]:=
```
y = newton[y]
```
Out[199]=
$$\frac{3}{2}$$

In[200]:=
```
N[Abs[y - Sqrt[2]], 20]
```
Out[200]=
$$0.085786437626904951198$$

In[201]:=
```
y = newton[y]
```
Out[201]=
$$\frac{17}{12}$$

In[202]:=
```
N[Abs[y - Sqrt[2]], 20]
```
Out[202]=
$$0.0024531042935716178650$$

In[203]:=
```
y = newton[y]
```
Out[203]=
$$\frac{577}{408}$$

In[204]:=
```
N[Abs[y - Sqrt[2]], 20]
```
Out[204]=
$$2.12390141475511987 99\times 10^{-6}$$

In[205]:=
```
y = newton[y]
```
Out[205]=
$$\frac{665\,857}{470\,832}$$

In[206]:=
```
N[Abs[y - Sqrt[2]], 20]
```
Out[206]=
$$1.594861824606854 6804\times 10^{-12}$$

In[207]:=
```
y = newton[y]
```
Out[207]=
$$\frac{886\,731\,088\,897}{627\,013\,566\,048}$$

In[208]:=
```
N[Abs[y - Sqrt[2]], 20]
```
Out[208]=
$$8.992928321650453 1005\times 10^{-25}$$

In[209]:=
```
y = newton[y]
```
Out[209]=
$$\frac{1\,572\,584\,048\,032\,918\,633\,353\,217}{1\,111\,984\,844\,349\,868\,137\,938\,112}$$

In[210]:=
```
N[Abs[y - Sqrt[2]], 20]
```
Out[210]=
$$2.859283843333951 2253\times 10^{-49}$$

In[211]:=
```
y = newton[y]
```
Out[211]=
$$\frac{4\,946\,041\,176\,255\,201\,878\,775\,086\,487\,573\,351\,061\,418\,968\,498\,177}{3\,497\,379\,255\,757\,941\,172\,020\,851\,852\,070\,562\,919\,437\,964\,212\,608}$$

In[212]:=
```
Block[{$MaxExtraPrecision = 10 000}, N[Abs[y - Sqrt[2]], 20]]
```
Out[212]=
$$2.890477193215364 5533\times 10^{-98}$$

In[213]:=
```
y = newton[y]
```
Out[213]=
$$\frac{48\,926\,646\,634\,423\,881\,954\,586\,808\,839\,856\,694\,558\,492\,182\,258\,668\,537\,145\,547\,700\,898\,547\,222\,910\,968\,507\,268\,117\,381\,704\,646\,657}{34\,596\,363\,615\,919\,099\,765\,318\,545\,389\,014\,861\,517\,389\,860\,071\,988\,342\,648\,187\,104\,766\,246\,565\,694\,525\,469\,768\,325\,292\,176\,831\,232}$$

In[214]:=
```
Block[{$MaxExtraPrecision = 10 000}, N[Abs[y - Sqrt[2]], 20]]
```
Out[214]=
$$2.953888516837038 2051\times 10^{-196}$$

In[215]:=
```
y = newton[y]
```
Out[215]=
$$\frac{4\,787\,633\,501\,779\,563\,550\,338\,751\,478\,164\,352\,626\,393\,810\,985\,192\,405\,254\,654\,229\,276\,251\,925\,362\,787\,770\,306\,352\,384\,325\,384\,596\,398\,594\,331\,240\,032\,637\,710\,299\,217\,577\,668\,263\,130\,246\,892\,221\,798\,809\,427\,255\,174\,348\,445\,597\,103\,634\,783\,814\,035\,090\,442\,551\,297}{3\,385\,368\,114\,944\,226\,131\,160\,489\,088\,412\,764\,413\,184\,597\,197\,600\,430\,424\,080\,424\,489\,217\,455\,640\,335\,520\,865\,446\,091\,847\,042\,392\,283\,395\,113\,030\,493\,175\,270\,757\,327\,077\,204\,943\,610\,618\,917\,073\,241\,080\,260\,452\,775\,055\,121\,081\,948\,254\,768\,847\,591\,544\,963\,982\,848}$$

In[216]:=
```
Block[{$MaxExtraPrecision = 10 000}, N[Abs[y - Sqrt[2]], 20]]
```
Out[216]=
$$3.084915037605821 0531\times 10^{-392}$$

In[217]:=
```
y = newton[y]
```
Out[217]=
$$\frac{45\,842\,869\,094\,724\,092\,282\,256\,664\,559\,525\,216\,692\,173\,091\,162\,526\,497\,018\,856\,817\,207\,453\,767\,127\,095\,354\,052\,418\,072\,639\,857\,700\,888\,691\,134\,361\,639\,497\,243\,771\,528\,176\,716\,782\,876\,457\,748\,796\,945\,284\,249\,594\,870\,200\,383\,920\,805\,322\,146\,999\,777\,923\,783\,319\,507\,727\,283\,850\,422\,831\,309\,915\,607\,777\,814\,766\,948\,159\,289\,963\,355\,518\,294\,865\,659\,883\,896\,712\,136\,501\,856\,004\,613\,518\,112\,550\,490\,551\,045\,680\,741\,845\,733\,583\,765\,205\,748\,593\,300\,762\,225\,277\,706\,242\,970\,719\,821\,414\,680\,060\,203\,467\,479\,543\,923\,750\,220\,952\,764\,417}{32\,415\,803\,605\,926\,610\,717\,906\,209\,990\,215\,925\,889\,160\,576\,452\,720\,547\,724\,429\,585\,547\,651\,493\,040\,781\,333\,832\,362\,975\,891\,811\,042\,370\,960\,101\,005\,436\,793\,459\,936\,444\,123\,023\,843\,707\,180\,863\,927\,766\,463\,725\,709\,098\,731\,479\,142\,615\,931\,281\,199\,106\,042\,945\,274\,354\,413\,006\,295\,825\,020\,803\,450\,451\,201\,071\,934\,075\,872\,286\,636\,802\,447\,240\,751\,072\,096\,022\,370\,680\,513\,420\,925\,571\,815\,159\,954\,608\,073\,162\,324\,835\,009\,657\,121\,509\,219\,599\,603\,167\,122\,882\,578\,517\,323\,407\,726\,312\,472\,428\,238\,351\,392\,267\,283\,960\,361\,495\,336\,307\,712}$$

In[218]:=
```
Block[{$MaxExtraPrecision = 10 000}, N[Abs[y - Sqrt[2]], 20]]
```
Out[218]=
$$3.364661831299793 1008\times 10^{-784}$$