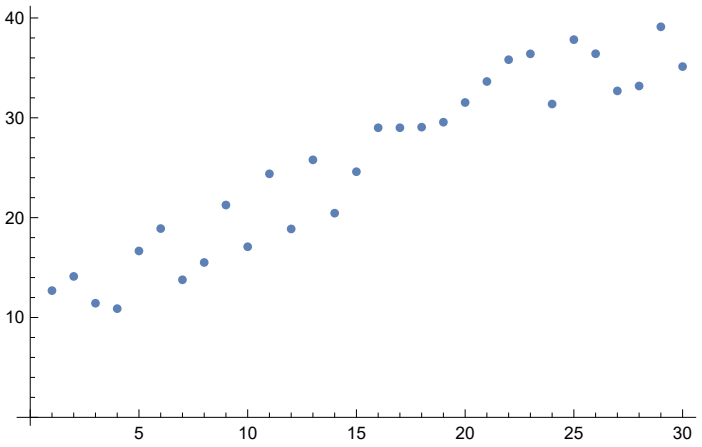
Градиентный спуск для одной переменной

In[•]:=
```
data = Table[{i, RandomReal[3] * 3 + i + 5}, {i, 1, 30}];
```

In[•]:=
```
ListPlot[data]
```

Out[•]=



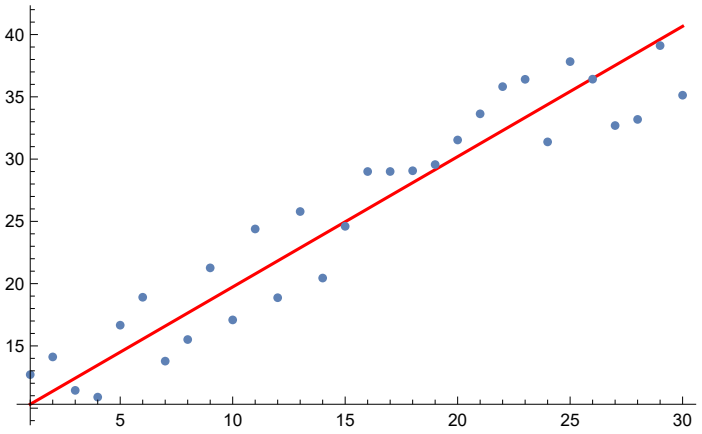
In[•]:=
```
LinearModelFit[Y, x, x]
```

Out[•]=

FittedModel[9.26797 + 1.04646 x]

In[•]:=
```
Show[Plot[9.267973674261254` + 1.0464626524494172` x,
  {x, 1, 30}, PlotStyle → Red], ListPlot[data]]
```

Out[•]=



In[•]:=
```
Y = data[[All, 2]];
X = {data[[All, 1]], ConstantArray[1, 30]}^T;
```

In[•]:=
```
Clear[f]
f[a_, b_] := Total[(Y - X.{a, b})^2]
```

In[•]:=
```
grada = D[Total[(Y - X.{a, b})^2], a];
gradb = D[Total[(Y - X.{a, b})^2], b];
```

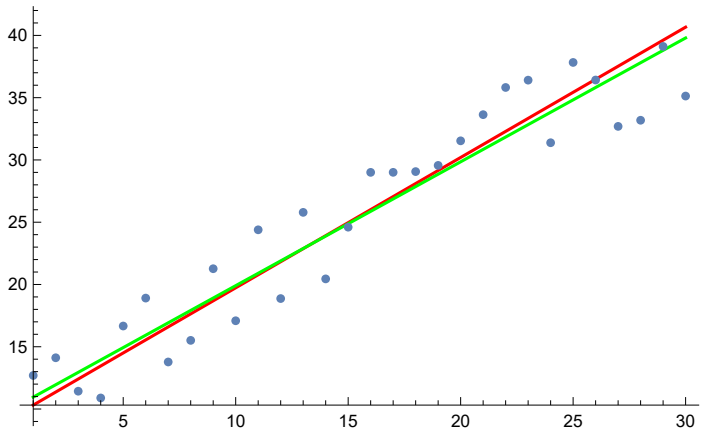
In[•]:=
```
Clear[df]
df[a0_, b0_] :=
  {D[Total[(Y - X.{a, b})^2], a], D[Total[(Y - X.{a, b})^2], b]} /. {a → a0, b → b0};
```

```
In[•]:= w0 = {0, 0};
        res = {};
        λ = 0.00001;

In[•]:= While[
         AppendTo[res, w0];
         w1 = w0 - λ df @@ w0;
         Norm[w1 - w0] > 0.0001,
         w0 = w1
        ]

In[•]:= Dynamic[w0]
Out[•]=
        {1.44029, 0.101018}

In[•]:= Show[Plot[9.267973674261254` + 1.0464626524494172` x, {x, 1, 30}, PlotStyle → Red],
         Plot[w0[[2]] + w0[[1]] x, {x, 1, 30}, PlotStyle → Green], ListPlot[data]]
Out[•]=
```



Стохастический градиентный спуск

```
In[•]:= Y = data[[All, 2]];
        X = {data[[All, 1]], ConstantArray[1, 30]}^T;

In[•]:= Clear[f]
        f[a_, b_] := Total[(Y - X.{a, b})^2]

In[•]:= Clear[df]
        df[a0_, b0_] := With[{point = RandomInteger[{1, Length@data}]},
            {D[(Y[[point]] - X[[point]].{a, b})^2, a],
              D[(Y[[point]] - X[[point]].{a, b})^2, b]} /. {a → a0, b → b0}];

In[•]:= w0 = {0, 0};
        res = {};
        λ = 0.00001;
```

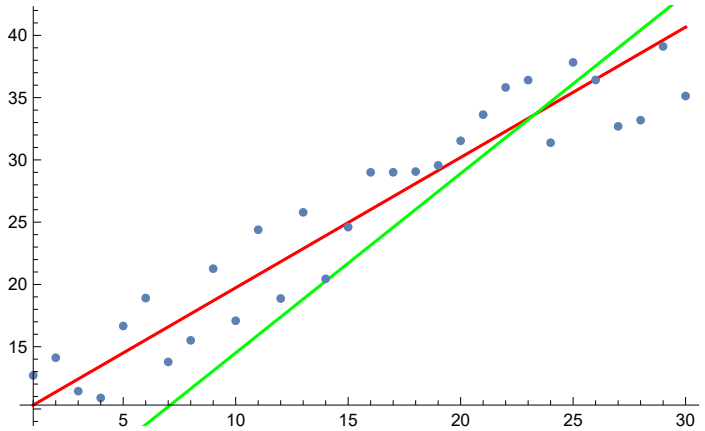
```
In[•]:= While[
         AppendTo[res, w0];
         w1 = w0 - λ df @@ w0;
         Norm[w1 - w0] > 0.0001,
         w0 = w1
        ]
```

```
In[•]:= Dynamic[w0]
```

```
Out[•]=
{1.44029, 0.101018}
```

```
In[•]:= Show[Plot[9.267973674261254` + 1.0464626524494172` x, {x, 1, 30}, PlotStyle → Red],
         Plot[w0[[2]] + w0[[1]] x, {x, 1, 30}, PlotStyle → Green], ListPlot[data]]
```

```
Out[•]=
```




```
In[•]:= D[(y - a x + b)^2, a]
```

```
Out[•]=
-2 x (b - a x + y)
```

```
In[•]:= D[(y - a x + b)^2, b]
```

```
Out[•]=
2 (b - a x + y)
```