```
(*Video 1: Derivatives*)
```

In[236]:=
```
D[x^3, x]
```
Out[236]= $3\,x^2$

In[237]:=
```
D[x^n, x]
```
Out[237]= $n\,x^{-1+n}$

In[238]:=
```
D[x^4 + 2 x^2 - 1, x]
```
Out[238]= $4\,x + 4\,x^3$

In[239]:=
```
f[x_] := 1 / 2 x^6 - 8 x^3 + 1
```

In[245]:=
```
f[x]
```
Out[245]= $1 - 8\,x^3 + \frac{x^6}{2}$

In[249]:=
```
f'[x]
```
Out[249]= $-24\,x^2 + 3\,x^5$

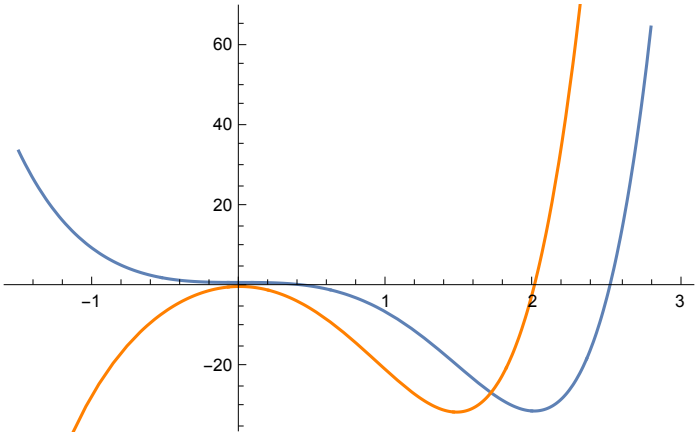
In[253]:=
```
f'[5]
```
Out[253]= 8775

In[255]:=
```
D[1 / 2 x^6 - 8 x^3 + 1, x]
```
Out[255]= $-24\,x^2 + 3\,x^5$

In[256]:=
```
-24 x^2 + 3 x^5 /. x → 5
```
Out[256]= 8775

```
graphf = Plot[f[x], {x, -1.5, 3}];
graphfprime = Plot[f'[x], {x, -1.5, 3}, PlotStyle → Orange];
Show[graphf, graphfprime]
```

Out[263]=



In[274]:=
```
Clear[f, graphf, graphfprime]
```

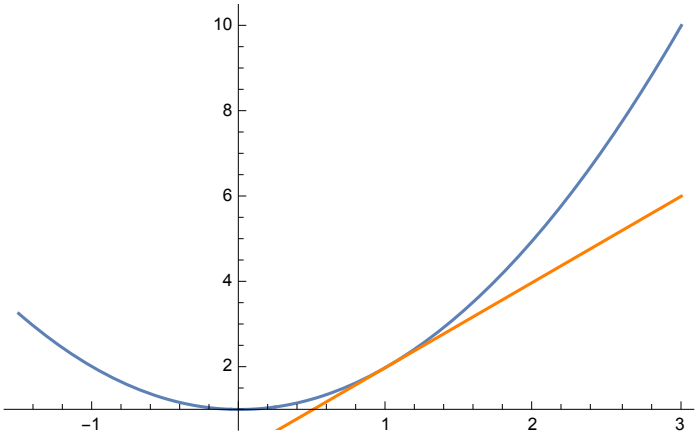
In[269]:=
```
f[x_] := x^2 + 1
```

In[273]:=
```
f'[x]
```

Out[273]=
$$2\,x$$

In[270]:=
```
graphf = Plot[f[x], {x, -1.5, 3}];
graphfprime = Plot[f'[x], {x, -1.5, 3}, PlotStyle → Orange];
Show[graphf, graphfprime]
```

Out[272]=



In[369]:=
```
(*Video 2: Tangent lines*)
f[x_] := x^2 + 1
```

In[327]:=
```
f'[x0]
```

Out[327]=
$$2\,x0$$

In[328]:=
```
f[x0]
```

Out[328]=
$$1 + x0^2$$

In[333]:=
```
(*The equation of the tangent line to
 the graph of f[x] at the point (x0,f[x0]) is:*)
y[x] = f'[x0] (x - x0) + f[x0]
```

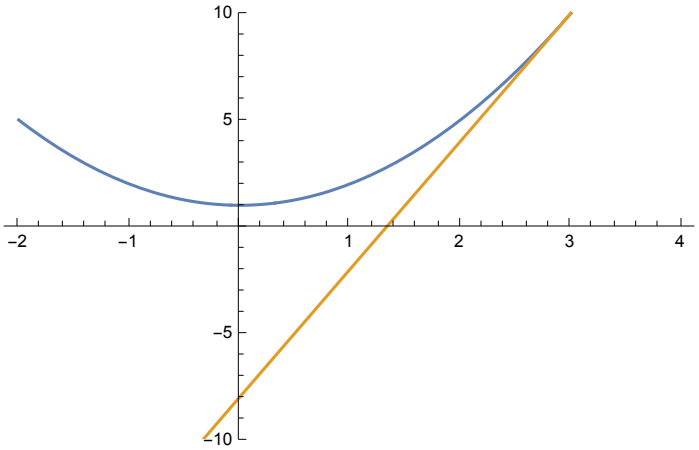
In[348]:=
```
f'[x0]
```

Out[348]=
$$6$$

In[349]:=
```
x0 = 3;
Simplify[f'[x0] (x - x0) + f[x0]]
Plot[{f[x], f'[x0] (x - x0) + f[x0]}, {x, -2, 4}, PlotRange → {-10, 10}]
```

Out[350]= $-8+6\,x$

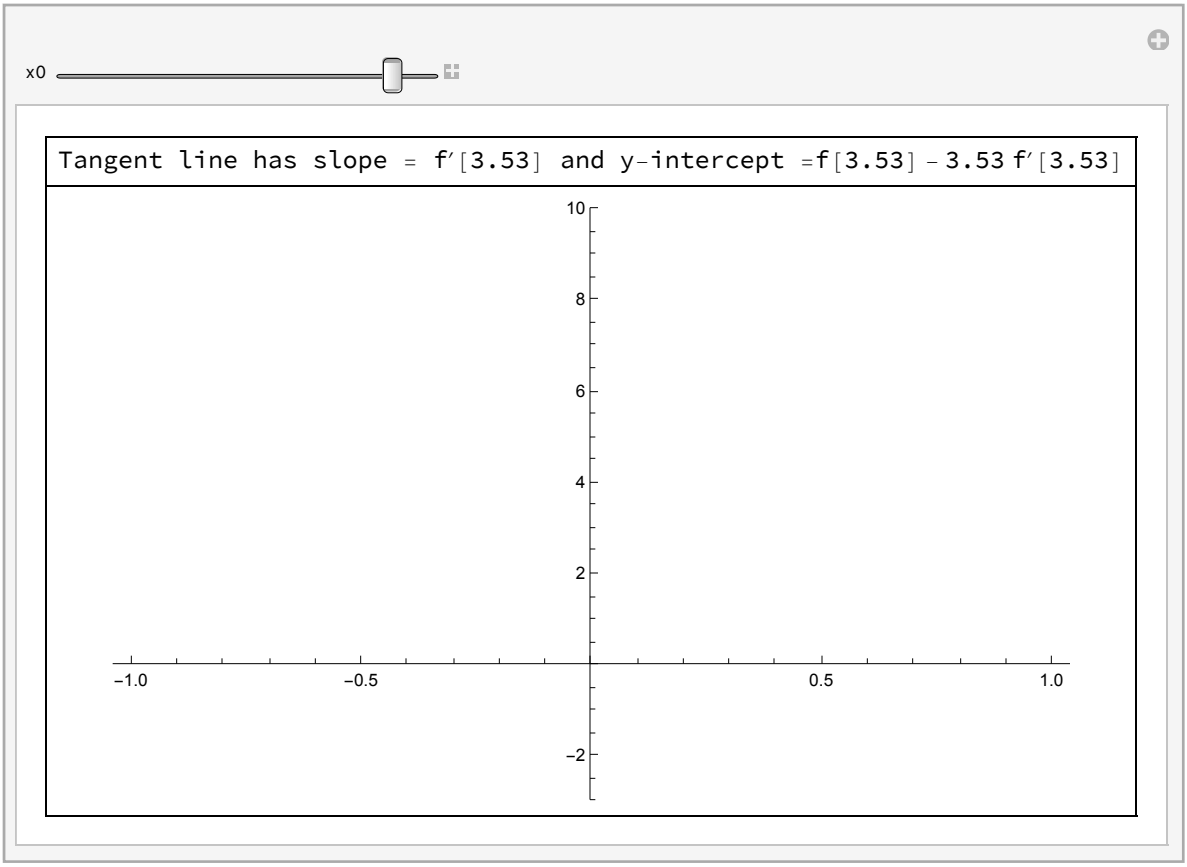
Out[351]=



In[352]:=
```
Clear[x0]
```

In[370]:=
```
Manipulate[Grid[{{Row[{"Tangent line has slope = ",
        f'[x0], " and y-intercept =", f[x0] - x0 f'[x0]}]},
    {Plot[{f[x], f'[x0] (x - x0) + f[x0]}, {x, -2, 4}, PlotRange → {-3, 10},
      ImageSize → 500]}}, Spacings → {1, 1}, Frame → All], {{x0, 1}, -2, 4}]
```

Out[370]=



In[385]:=
```
Clear[f]
```

In[375]:=
```
f[x_] := x^3 - 4 x^2 + x + 2
y[x] = f'[x0] (x - x0) + f[x0]
```

Out[376]= $2 + x0 - 4\,x0^2 + x0^3 + (x - x0)\left(1 - 8\,x0 + 3\,x0^2\right)$

In[384]:=
```
Manipulate[
 Grid[{{Row[{"Tangent line at ", x0, " has slope = ", f'[x0], " and y-intercept =",
      f[x0] - x0 f'[x0]}]}, {Plot[{f[x], f'[x0] (x - x0) + f[x0]},
    {x, -2, 4}, PlotRange → {-6, 10}, ImageSize → 600]}},
  Spacings → {1, 1}, Frame → All], {{x0, 1}, -2, 4}]
```

Out[384]=