```
(*Video 1: Factoring some polynomials*)
```

In[•]:= Factor[x^2 - 4 x + 4]

Out[•]= $(-2+x)^2$

In[•]:= Expand[$(-3+x)^2$]
Expand[$(x-3)^2$]

Out[•]= $9-6x+x^2$

Out[•]= $9-6x+x^2$

In[•]:= Factor[x^2 - 2 c x + c^2]

Out[•]= $(c-x)^2$

In[•]:= Expand[$(a-x)^2$]

Out[•]= $a^2-2ax+x^2$

In[46]:= Factor[x^2 - 1 / 3 x + 1 / 36]

Out[46]= $\frac{1}{36}(-1+6x)^2$

In[48]:= Solve[-2 c == -1 / 3, c]

Out[48]= $\left\{\left\{c\to\frac{1}{6}\right\}\right\}$

In[49]:= Simplify[$\frac{1}{36}(-1+6x)^2 == \left(\frac{1}{6}-x\right)^2$]

Out[49]= True

In[•]:= Factor[x^2 - 16]

Out[•]= $(-4+x)(4+x)$

In[51]:= Factor[x^4-10x^2+25]

Out[51]= $\left(-5+x^2\right)^2$

In[53]:= Expand[(x - 2) ^3]

Out[53]= $-8+12x-6x^2+x^3$

In[•]:= Factor[$-8+12x-6x^2+x^3$]

Out[•]= $(-2+x)^3$

In[54]:= Expand[(x - 2) ^15]

Out[54]= $-32768+245760x-860160x^2+1863680x^3-2795520x^4+3075072x^5-2562560x^6+1647360x^7-823680x^8+320320x^9-96096x^{10}+21840x^{11}-3640x^{12}+420x^{13}-30x^{14}+x^{15}$

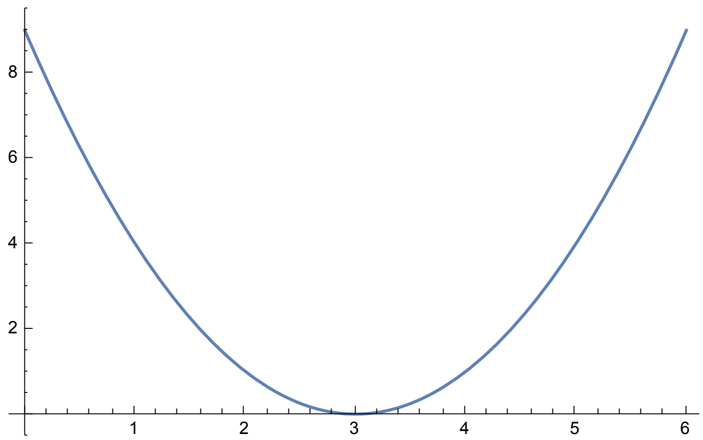
In[55]:= Factor$[-32\,768 + 245\,760\,x - 860\,160\,x^2 + 1\,863\,680\,x^3 - 2\,795\,520\,x^4 + 3\,075\,072\,x^5 - 2\,562\,560\,x^6 + 1\,647\,360\,x^7 - 823\,680\,x^8 + 320\,320\,x^9 - 96\,096\,x^{10} + 21\,840\,x^{11} - 3640\,x^{12} + 420\,x^{13} - 30\,x^{14} + x^{15}]$

Out[55]= $(-2 + x)^{15}$

```
(*Video 2: Plots *)
```

In[6]:= `Plot[x^2 - 6 x + 9, {x, 0, 6}]`

Out[6]=

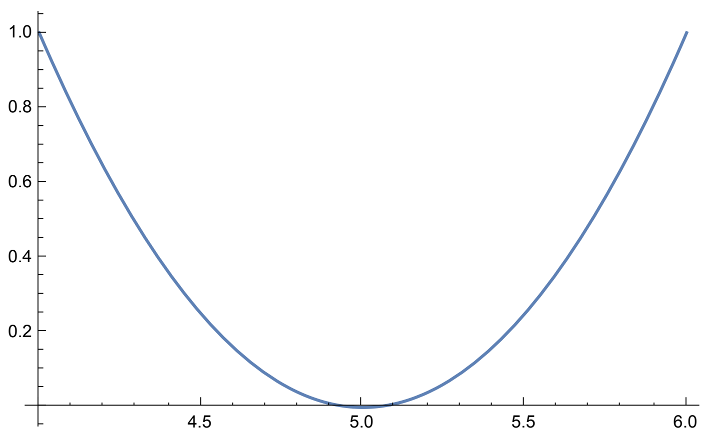


In[56]:= `Factor[x^2 - 6 x + 9](* (x-3)^2 *)`

Out[56]= $(-3 + x)^2$

In[57]:= Plot$[(-5 + x)^2$, {x, 4, 6}]

Out[57]=

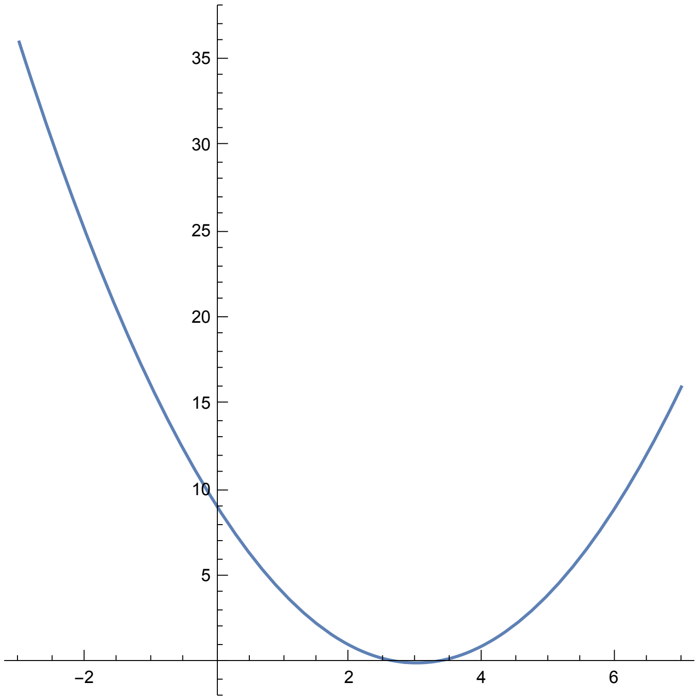


In[25]:=
```
Manipulate[Plot[t (x - a) ^2 + c, {x, -10, 10}, PlotRange -> {-2, 2}],
 {a, -10, 10}, {c, -2, 2}, {t, -2, 2}]
```

Out[25]=

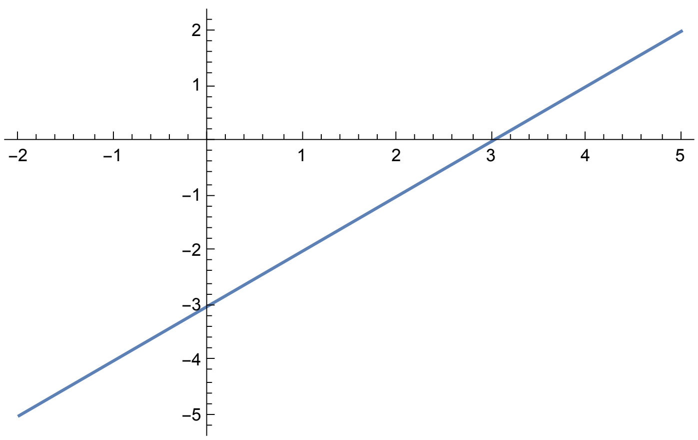
In[58]:= `Plot[x^2 - 6 x + 9, {x, -3, 7}, AspectRatio -> 1]`

Out[58]=



In[34]:= `Plot[(x^2 - 6 x + 9) / (x - 3), {x, -2, 5}]`

Out[34]=

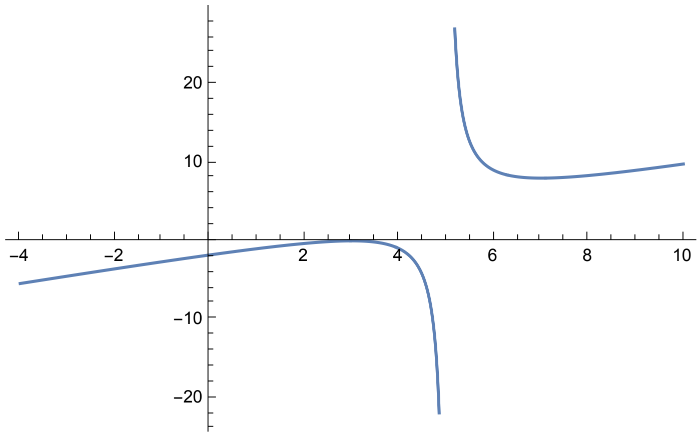


In[35]:= `Simplify[(x^2 - 6 x + 9) / (x - 3)]`

Out[35]= $-3 + x$

In[45]:=
```
Plot[(x^2 - 6 x + 9) / (x - 5), {x, -4, 10}]
```

Out[45]=




```
(*Video 3: Limits *)
```

In[59]:=
```
Limit[x^2 - 6 x + 9, x -> 1]
```

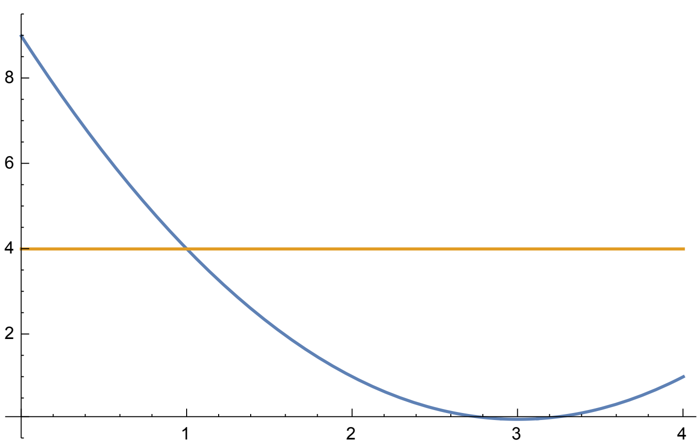
Out[59]= 4

In[62]:=
```
x = 1;
x^2 - 6 x + 9
```

Out[63]= 4

In[67]:=
```
Plot[{x^2 - 6 x + 9, 4}, {x, 0, 4}]
```

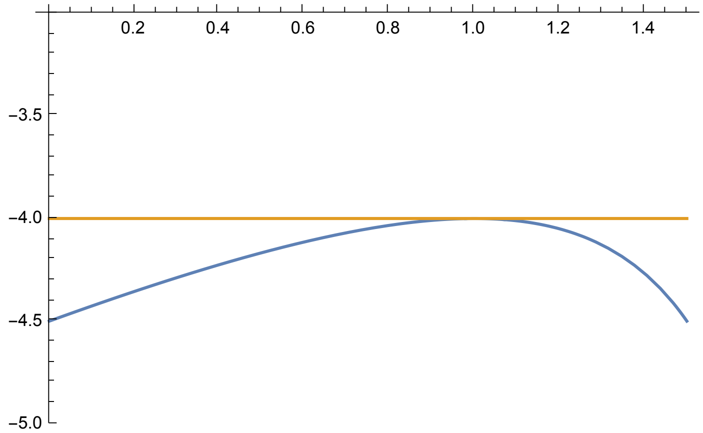
Out[67]=



In[74]:=
```
Limit[(x^2 - 6 x + 9) / (x - 2), x -> 1]
```

Out[74]= -4

In[80]:=
```
Plot[{(x^2 - 6 x + 9) / (x - 2), -4}, {x, 0, 1.5}, PlotRange → {-5, -3}]
```

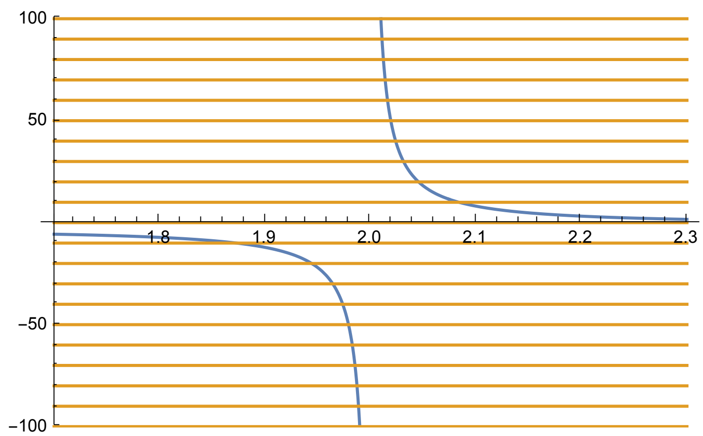
Out[80]=



```
(*There IS a single value (yellow line) where the function accumulates!*)
```

In[70]:=
```
Limit[(x^2 - 6 x + 9) / (x - 2), x -> 2]
```

Out[70]= Indeterminate

In[97]:=
```
(*Recall the plot:*)
Plot[{(x^2 - 6 x + 9) / (x - 2), Table[{n}, {n, -100, 100, 10}]},
 {x, 1.7, 2.3}, PlotRange → 100]
```

Out[97]=



```
(*There is no single value (yellow line) where the function accumulates!*)
```

In[86]:=
```
(*Directional limit*)
Limit[(x^2 - 6 x + 9) / (x - 2), x -> 2, Direction → "FromBelow"]
```

Out[86]= $-\infty$

In[87]:=
```
(*Directional limit*)
Limit[(x^2 - 6 x + 9) / (x - 2), x -> 2, Direction → "FromAbove"]
```

Out[87]= ∞

```
In[92]:= (*Directional limit*)
Limit[(x^2 - 6 x + 9) / (x - 2), x → 2, Direction → "FromBelow"]
Limit[(x^2 - 6 x + 9) / (x - 2), x → 2, Direction → "FromAbove"]

Out[92]= -∞

Out[93]= ∞

In[94]:= Limit[(x^2 - 6 x + 9) / (x - 2), x → 2]

Out[94]= Indeterminate
```