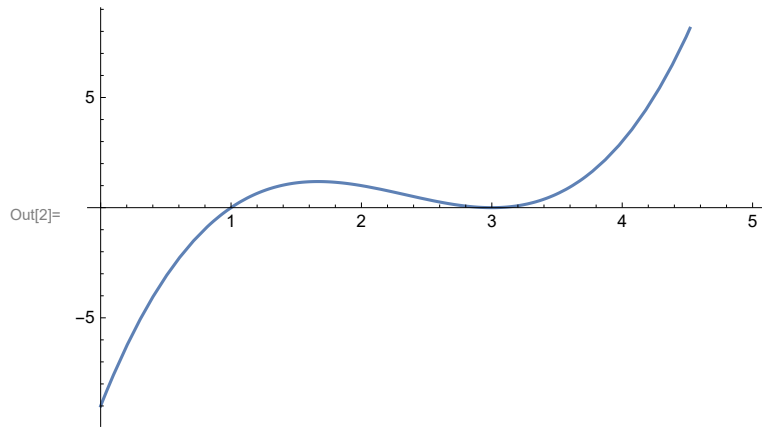


W4 - P1a

In[1]:= **Solve**[$\partial_x (x^3 - 7x^2 + 15x - 9) == 0, x]$
Plot[$x^3 - 7x^2 + 15x - 9, \{x, -0, 5\}$]

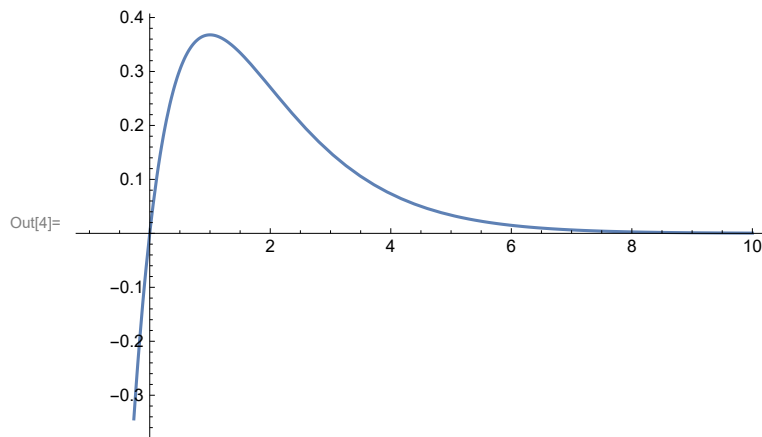
Out[1]= $\left\{ \left\{ x \rightarrow \frac{5}{3} \right\}, \{x \rightarrow 3\} \right\}$



W4 - P1b

In[3]:= **Solve**[$\partial_x (x \text{Exp}[-x]) == 0, x]$
Plot[$x \text{Exp}[-x], \{x, -1, 10\}$]

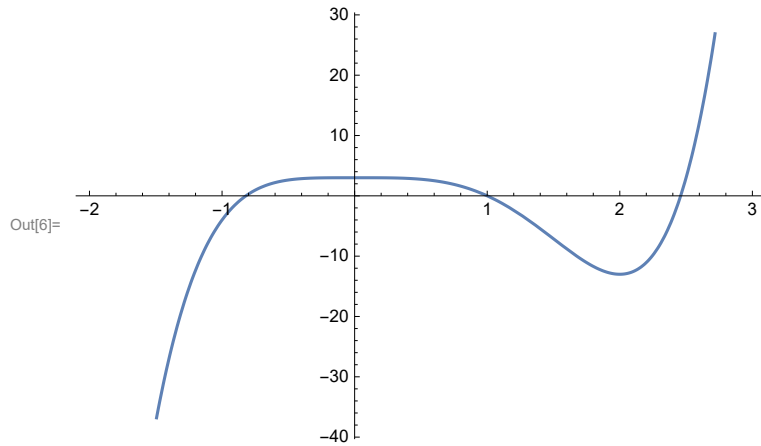
Out[3]= $\{ \{x \rightarrow 1\} \}$



W4 - P1c

In[5]:= **Solve**[$\partial_x (2x^5 - 5x^4 + 3) == 0, x]$
Plot[$2x^5 - 5x^4 + 3, \{x, -2, 3\}$]

Out[5]= $\{\{x \rightarrow 0\}, \{x \rightarrow 0\}, \{x \rightarrow 0\}, \{x \rightarrow 2\}\}$



W4 - P2

In[7]:= $\partial_x (x^3 - 7x^2 + 16x - 10) /. \{x \rightarrow 2\}$
 $\partial_{x,x} (x^3 - 7x^2 + 16x - 10) /. \{x \rightarrow 2\}$

Out[7]= 0

Out[8]= -2

In[9]:= $\partial_x (x^3 - 7x^2 + 16x - 10) /. \{x \rightarrow 8/3\}$
 $\partial_{x,x} (x^3 - 7x^2 + 16x - 10) /. \{x \rightarrow 8/3\}$

Out[9]= 0

Out[10]= 2

W4 - P3

In[11]:= **\$Assumptions = a > 0 && b > 0;**
Minimize[$\{\frac{a}{r^{12}} - \frac{b}{r^6}, r > 0\}, r]$ // **FullSimplify**

Out[12]= $\{-\frac{b^2}{4a}, \{r \rightarrow 2^{1/6} \left(\frac{a}{b}\right)^{1/6}\}\}$

In[13]:= **Solve**[$\{r_e == 2^{1/6} \left(\frac{a}{b}\right)^{1/6}, U_B == -\frac{b^2}{4a}\}, \{a, b\}]$

Out[13]= $\{\{a \rightarrow -r_e^{12} U_B, b \rightarrow -2 r_e^6 U_B\}\}$

In[14]:= $\frac{a}{r^{12}} - \frac{b}{r^6} /. \{a \rightarrow U_B r_e^{12}, b \rightarrow 2 U_B r_e^6\}$

Out[14]= $-\frac{2 r_e^6 U_B}{r^6} + \frac{r_e^{12} U_B}{r^{12}}$

W4 - P4

```
In[15]:= $Assumptions = k > 0 && T > 0 && m > 0;
p[v_] := 4 π (m / (2 π k T))3/2 v2 Exp[- m v2 / (2 k T)];
Solve[∂v p[v] == 0, v] // FullSimplify
```

```
Out[17]= {{v -> 0}, {v -> -√2 √(k T / m)}, {v -> √2 √(k T / m)}}
```

```
In[18]:= √(2 k T / m) /. {k -> 1.380 × 10-23, T -> 298, m -> 0.028 / (6.022 × 1023)}
```

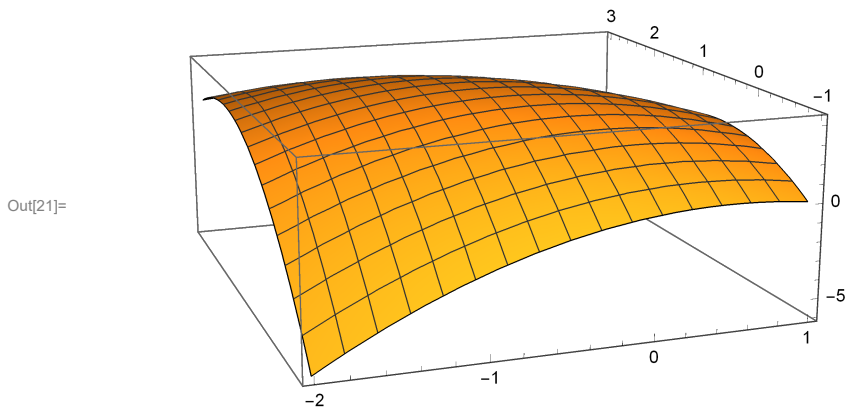
```
Out[18]= 420.585
```

W4 - P5a

```
In[19]:= f[x_, y_] := 3 - x2 - x y - y2 + 2 y;
Solve[{∂x f[x, y] == 0, ∂y f[x, y] == 0}, {x, y}]
```

```
Out[20]= {{x -> -2/3, y -> 4/3}}
```

```
In[21]:= Plot3D[f[x, y], {x, -2, 1}, {y, -1, 3}]
```



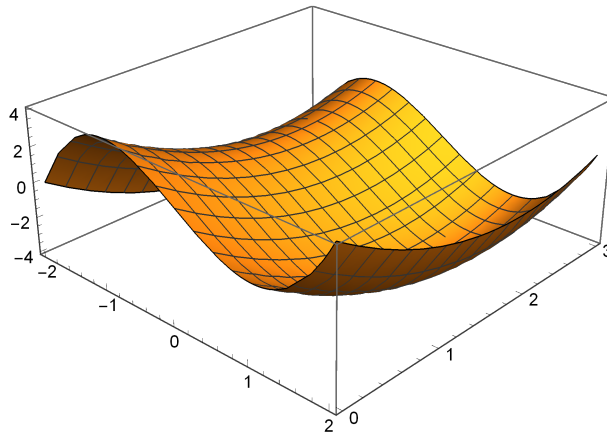
W4 - P5b

```
In[22]:= f[x_, y_] := x3 + y2 - 3 x - 4 y + 2;
Solve[{∂x f[x, y] == 0, ∂y f[x, y] == 0}, {x, y}]
```

```
Out[23]= {{x -> -1, y -> 2}, {x -> 1, y -> 2}}
```

```
In[24]:= Plot3D[f[x, y], {x, -2, 2}, {y, 0, 3}]
```

```
Out[24]=
```



Least squares formulae

```
In[25]:= a[x_, y_, n_] := 
$$\frac{n \sum_{k=1}^n (x[[k]] y[[k]]) - (\sum_{k=1}^n x[[k]]) (\sum_{k=1}^n y[[k]])}{n \sum_{k=1}^n (x[[k]]^2) - (\sum_{k=1}^n x[[k]])^2};$$

```

```
b[x_, y_, n_] := 
$$\frac{(\sum_{k=1}^n y[[k]]) (\sum_{k=1}^n (x[[k]]^2)) - (\sum_{k=1}^n x[[k]]) (\sum_{k=1}^n (x[[k]] y[[k]]))}{n \sum_{k=1}^n (x[[k]]^2) - (\sum_{k=1}^n x[[k]])^2};$$

```

W4 - P6a, BCA

```
In[27]:= x = {0.00, 0.10, 0.25, 0.50, 0.75, 1.25, 2.50};
y = {0.000, 0.046, 0.136, 0.209, 0.299, 0.484, 0.862};
a[x, y, 7]
b[x, y, 7]
```

```
Out[29]= 0.340944
```

```
Out[30]= 0.0302786
```

W4 - P6a, Bradford

```
In[31]:= x = {0.00, 0.10, 0.25, 0.50, 0.75, 1.25, 2.50};
y = {0.000, 0.039, 0.123, 0.182, 0.261, 0.409, 0.620};
a[x, y, 7]
b[x, y, 7]
```

```
Out[33]= 0.246021
```

```
Out[34]= 0.0453979
```

W4 - P6b, BCA

```
In[35]:= y = {0.00, 0.10, 0.25, 0.50, 0.75, 1.25, 2.50};
x = {0.000, 0.046, 0.136, 0.209, 0.299, 0.484, 0.862};
a[x, y, 7]
b[x, y, 7]
```

```
Out[37]= 2.91618
```

```
Out[38]= -0.0839064
```

W4 - P6b, Bradford

```
In[39]:= y = {0.00, 0.10, 0.25, 0.50, 0.75, 1.25, 2.50};  
x = {0.000, 0.039, 0.123, 0.182, 0.261, 0.409, 0.620};  
a[x, y, 7]  
b[x, y, 7]
```

```
Out[41]= 3.93473
```

```
Out[42]= -0.154193
```

W4 - P7, using Bradford result from P6b

```
In[43]:= c[a_] := 3.93473 * a - 0.15419;  
c[0.118]  
c[0.119]  
c[0.156]  
c[0.155]
```

```
Out[44]= 0.310108
```

```
Out[45]= 0.314043
```

```
Out[46]= 0.459628
```

```
Out[47]= 0.455693
```

W4 - P8

```
In[48]:= x = {1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0};  
y = {4.4, 4.9, 6.4, 7.3, 8.8, 10.3, 11.7, 13.2, 14.8, 15.3, 16.5, 17.2};  
a[x, y, 12]  
b[x, y, 12]
```

```
Out[50]= 1.25734
```

```
Out[51]= 2.72727
```