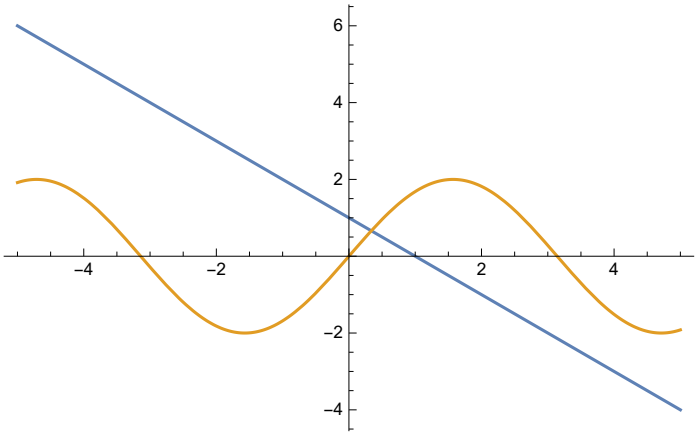
W5 P1a

In[1]:=
```
Plot[{1 - x, 2 Sin[x]}, {x, -5, 5}]
```

Out[1]=



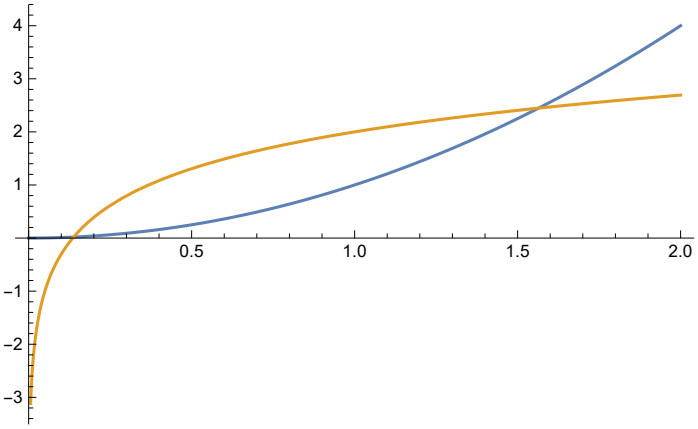
In[2]:=
```
NSolve[1 - x == 2 Sin[x], x, Reals]
```

Out[2]=
```
{{x → 0.337584}}
```

W5 P1b

In[3]:=
```
Plot[{x^2, 2 + Log[x]}, {x, 0, 2}]
```

Out[3]=



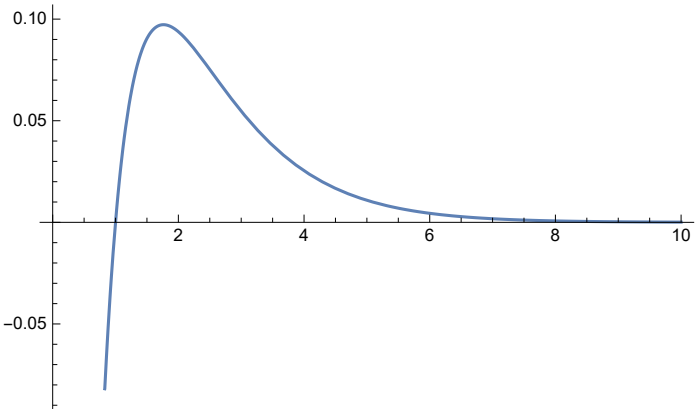
In[4]:=
```
NSolve[x^2 == 2 + Log[x], x, Reals]
```

Out[4]=
```
{{x → 0.137935}, {x → 1.56446}}
```

W5 P2a

In[5]:=
```
Plot[Exp[-x] Log[x], {x, 0, 10}]
```

Out[5]=



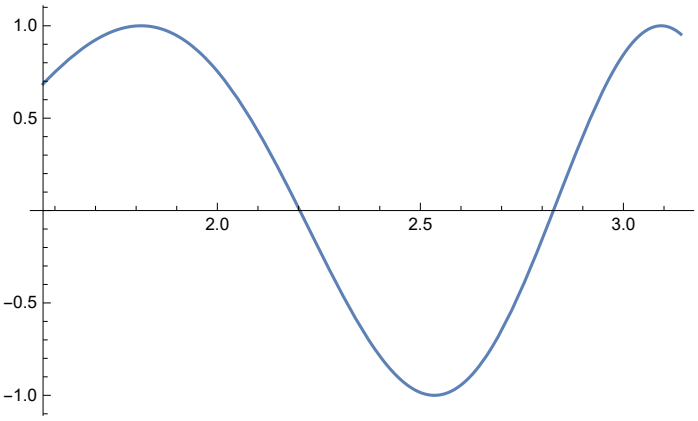
In[6]:=
```
NMaximize[{Exp[-x] Log[x], x > 0}, x]
```

Out[6]=
```
{0.0972601, {x → 1.76322}}
```

W5 P2b

In[7]:=
```
Plot[Cos[x^2 + 3], {x, π/2, π}]
```

Out[7]=



In[8]:=
```
NMaximize[{Cos[x^2 + 3], x > 2, x < π}, x]
NMaximize[{Cos[x^2 + 3], x > π/2, x < 2}, x]
```

Out[8]=
```
{1., {x → 3.09295}}
```

Out[9]=
```
{1., {x → 1.81196}}
```

In[10]:=
```
NMinimize[{Cos[x^2 + 3], x > π/2, x < π}, x]
```

Out[10]=
```
{-1., {x → 2.53471}}
```

W5 P3

In[11]:=
```
y[x_] := 2 x;
y'[x] dx
```

Out[12]=
```
2 dx
```

In[13]:=
```
y[x_] := 3 x^2 + 2 x + 1;
y'[x] dx
```
Out[14]= $dx\ (2 + 6\,x)$

In[15]:=
```
y[x_] := Sin[x];
y'[x] dx
```
Out[16]= $dx\ \text{Cos}[x]$

W5 P4

In[17]:=
```
V[r_] := 4/3 π r^3;
V'[r] dr
```
Out[18]= $4\ dr\ \pi\ r^2$

W5 P5

In[19]:=
```
f[x_, y_] := x^3 y^2 + Log[y];
D[f[x, y], x] dx + D[f[x, y], y] dy
```
Out[20]= $3\ dx\ x^2\ y^2 + dy\ \left(\frac{1}{y} + 2\,x^3\,y\right)$

In[21]:=
```
f[r_, θ_, φ_] := r Sin[θ] Sin[φ];
D[f[r, θ, φ], r] dr + D[f[r, θ, φ], θ] dθ + D[f[r, θ, φ], φ] dφ
```
Out[22]= $d\varphi\ r\ \text{Cos}[\varphi]\ \text{Sin}[\theta] + d\theta\ r\ \text{Cos}[\theta]\ \text{Sin}[\varphi] + dr\ \text{Sin}[\theta]\ \text{Sin}[\varphi]$

W5 P6

In[23]:=
```
D[4 x + 3 y, y] == D[3 x + 8 y, x]
```
Out[23]= True

In[24]:=
```
D[y Cos[x], y] == D[Sin[x], x]
```
Out[24]= True

W5 P7 - follows from the fact that mixed second derivatives of G must be equal.