In[9]:=
```
Table[Sum[ i^k , {i, 1, n}], {k, 1, 8}]
```

Out[9]=

$$\left\{\frac{1}{2}\,n\,(1+n),\ \frac{1}{6}\,n\,(1+n)\,(1+2\,n),\ \frac{1}{4}\,n^2\,(1+n)^2,\ \frac{1}{30}\,n\,(1+n)\,(1+2\,n)\,\left(-1+3\,n+3\,n^2\right),\ \frac{1}{12}\,n^2\,(1+n)^2\,\left(-1+2\,n+2\,n^2\right),\ \frac{1}{42}\,n\,(1+n)\,(1+2\,n)\,\left(1-3\,n+6\,n^3+3\,n^4\right),\ \frac{1}{24}\,n^2\,(1+n)^2\,\left(2-4\,n-n^2+6\,n^3+3\,n^4\right),\ \frac{1}{90}\,n\,(1+n)\,(1+2\,n)\,\left(-3+9\,n-n^2-15\,n^3+5\,n^4+15\,n^5+5\,n^6\right)\right\}$$

In[10]:=
```
Factor[Expand[(x + 1)(x + 2)(x + 3)(x + 4) + 1]]
```

Out[10]=

$$\left(5+5\,x+x^2\right)^2$$

In[11]:=
```
Table[PrimeQ[(n^2 + n + 41)], {n, 0, 39}]
```

Out[11]=

{True, True}

In[226]:=
```
y := 111
While[!PrimeQ[y], y = 10*y + 1]
PrimeQ[y]
Print[y]
```

Out[228]=

True

1 111 111 111 111 111 111

In[102]:=
```
f[x_*y_] := f[x] + f[y]
f[x_^n_Integer] := n * f[x]
f[n_Integer] := 0
v = f[Product[Factorial[k]*x_k^k, {k, 1, 20}]]
w = Sum[k*f[x_k], {k, 1, 20}]
v == w
```

Out[105]=

$$f[x_1]+2\,f[x_2]+3\,f[x_3]+4\,f[x_4]+5\,f[x_5]+6\,f[x_6]+7\,f[x_7]+8\,f[x_8]+9\,f[x_9]+10\,f[x_{10}]+11\,f[x_{11}]+12\,f[x_{12}]+13\,f[x_{13}]+14\,f[x_{14}]+15\,f[x_{15}]+16\,f[x_{16}]+17\,f[x_{17}]+18\,f[x_{18}]+19\,f[x_{19}]+20\,f[x_{20}]$$

Out[106]=

$$f[x_1]+2\,f[x_2]+3\,f[x_3]+4\,f[x_4]+5\,f[x_5]+6\,f[x_6]+7\,f[x_7]+8\,f[x_8]+9\,f[x_9]+10\,f[x_{10}]+11\,f[x_{11}]+12\,f[x_{12}]+13\,f[x_{13}]+14\,f[x_{14}]+15\,f[x_{15}]+16\,f[x_{16}]+17\,f[x_{17}]+18\,f[x_{18}]+19\,f[x_{19}]+20\,f[x_{20}]$$

Out[107]=

True

In[121]:=

```
f[x] := E^(-x)/(2 + Sin[x^2])
g[x] := D[f[x], x]
slope = g[x] /. x → 1
y = f[x] /. x → 1
Plot[{E^(-x)/(2 + Sin[x^2]), y + (x - 1)*slope}, {x, 0, 3}]
```

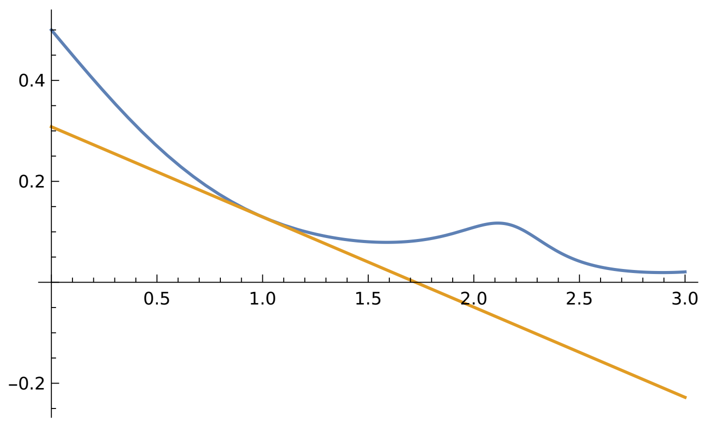
Out[123]=

$$-\frac{2\,\text{Cos}[1]}{e\,(2+\text{Sin}[1])^2}-\frac{1}{e\,(2+\text{Sin}[1])}$$

Out[124]=

$$\frac{1}{e\,(2+\text{Sin}[1])}$$

Out[125]=



In[177]:=

```
{0, .01, 1}
```

Out[177]=

```
{0, 0.01, 1}
```

In[223]:=

```
f[x] = E^(-x)/(2 + Sin[x^2])
g[x] = D[ f[x], x]
NIntegrate[f[x] - g[x] , {x, 0, 1}, WorkingPrecision → 100]
```

Out[223]=

$$\frac{e^{-x}}{2+\text{Sin}[x^2]}$$

Out[224]=

$$-\frac{2\,e^{-x}\,x\,\text{Cos}[x^2]}{(2+\text{Sin}[x^2])^2}-\frac{e^{-x}}{2+\text{Sin}[x^2]}$$

Out[225]=

0.6560225894307646832353054882557920612015043021329287922640223352970395793762171⋱
706166899933516202368

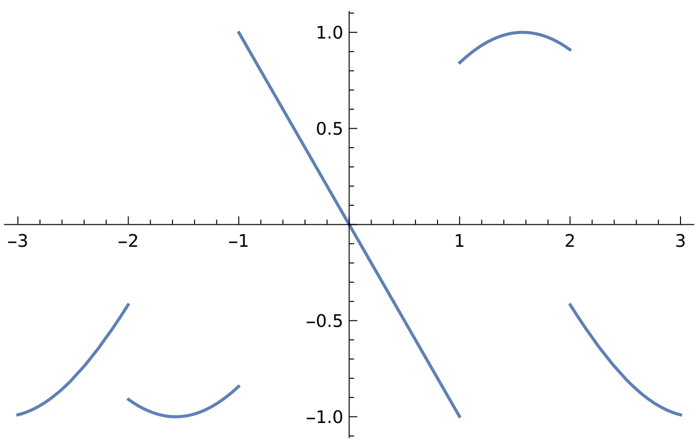
In[61]:=

```
h = Piecewise[{{-x, Abs[x] < 1}, {Sin[x], 1 ≤ Abs[x] < 2}, {Cos[x], Abs[x] ≥ 2}}]
Plot[h, {x, -3, 3}]
```

Out[61]=

$$\begin{cases} -x & \text{Abs}[x] < 1 \\ \text{Sin}[x] & 1 \le \text{Abs}[x] < 2 \\ \text{Cos}[x] & \text{Abs}[x] \ge 2 \\ 0 & \text{True} \end{cases}$$

Out[62]=



In[57]:=

```
Integrate[1/(1 + h^2), {x, -3, 3}]
```

Out[57]=

$$\frac{1}{2}\left(\pi+2\sqrt{2}\,\text{ArcCot}\left[\frac{(2-\text{Cos}[2]+\text{Cos}[4])\,\text{Cot}[1]}{\sqrt{2}}\right]+2\sqrt{2}\,\text{ArcCot}\left[\frac{\text{Cot}[1]+\text{Sin}[2]}{\sqrt{2}}\right]\right)$$