In[∘]:=
```
Integrate[x^2 + 4, x]
```
Out[∘]= $4x + \frac{x^3}{3}$

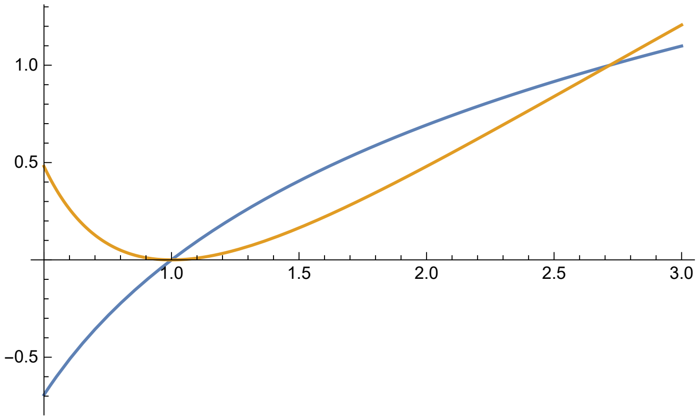
In[∘]:=
```
Integrate[x^2 + 4, {x, 1, 3}]
```
Out[∘]= $\frac{50}{3}$

In[∘]:=
```
Integrate[Sin[x]/Log[x], {x, 2, 5}]
```
Out[∘]= $\int_2^5 \frac{\mathrm{Sin}[x]}{\mathrm{Log}[x]} \, dx$

In[∘]:=
```
NIntegrate[Sin[x]/Log[x], {x, 2, 5}]
```
Out[∘]= -0.20523

In[∘]:=
```
Integrate[x^2 y, {x, 1, 3}, {y, 0, 5}]
```
Out[∘]= $\frac{325}{3}$

In[∘]:=
```
Plot[{Log[x], Log[x]^2}, {x, 0.5, 3}]
```
Out[∘]=



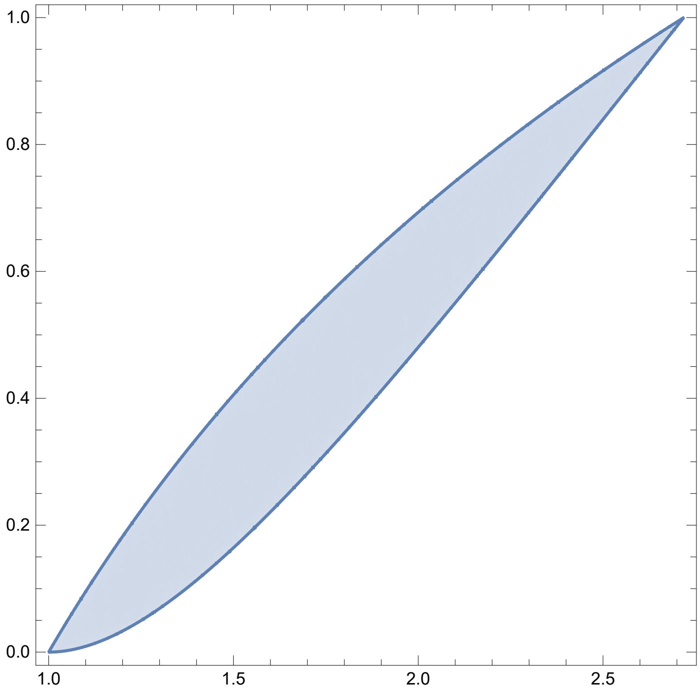

```
(* First Method *)
Solve[Log[x] == Log[x]^2, x]
```
Out[∘]= {{x → 1}, {x → e}}

In[∘]:=
```
Integrate[Log[x] - Log[x]^2, {x, 1, e}]
```
Out[∘]= 3 - e

In[∘]:=
```
(* Second Method *)
region = ImplicitRegion[{1 ≤ x ≤ E, Log[x]^2 ≤ y <= Log[x]}, {x, y}]
```
Out[∘]= ImplicitRegion[1 ≤ x ≤ e && Log[x]^2 ≤ y ≤ Log[x], {x, y}]

In[∘]:=
```
RegionPlot[region]
```

Out[∘]=



In[∘]:=
```
Integrate[1, {x, y} ∈ region]
```

Out[∘]= $3 - e$

In[∘]:=
```
(* Third Method *)
Integrate[1, {x, 1, E}, {y, Log[x]^2, Log[x]}]
```

Out[∘]= $3 - e$

```
(* Task1 // for Hubul *)
v[t_] := 0.001302 t^3 - 0.09029 t^2 + 23.61 t - 3.083;
Minimize[{v'[t], 0 <= t ≤ 126}, t]
```

Out[∘]= {21.5229, {t → 23.1157}}

In[∘]:=
```
Maximize[{v'[t], 0 ≤ t ≤ 126}, t]
```

Out[∘]= {62.8686, {t → 126.}}

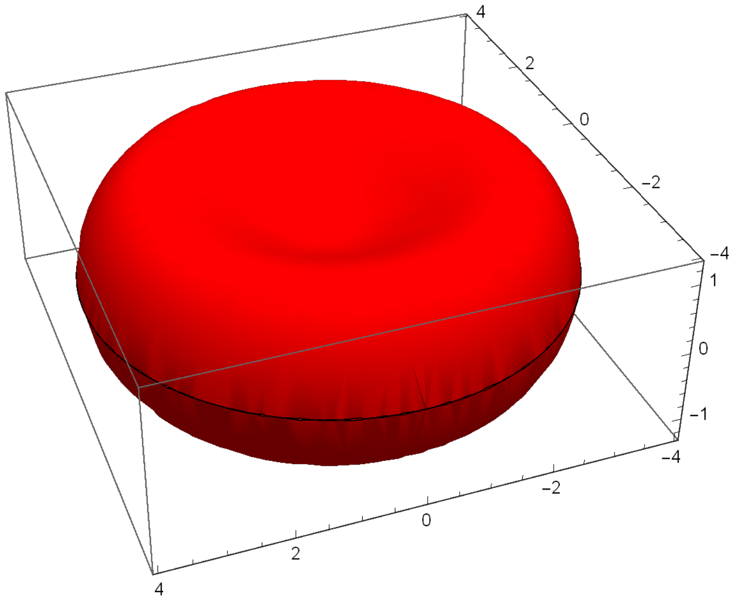
In[∘]:=
```
(* Task2 *)
a0 = 0.0518;
a1 = 2.0026;
a2 = -4.491;
d0 = 7.82;
```

$$z1[x\_, y\_] := d_0 \sqrt{1 - \frac{4 (x^2 + y^2)}{d_0^2}} \left(a_0 + \frac{a_1 (x^2 + y^2)}{d_0^2} + \frac{a_2 (x^2 + y^2)^2}{d_0^4}\right);$$

$$z2[x\_, y\_] := -d_0 \sqrt{1 - \frac{4 (x^2 + y^2)}{d_0^2}} \left(a_0 + \frac{a_1 (x^2 + y^2)}{d_0^2} + \frac{a_2 (x^2 + y^2)^2}{d_0^4}\right);$$

```
Plot3D[{z1[x, y], z2[x, y]}, {x, -5, 5}, {y, -5, 5}, PlotStyle → Red, Mesh -> None]
```

Out[∘]=



In[∘]:=
```
Clear[y]
```

In[∘]:=
$$\text{Reduce}\left[d_0 \sqrt{1 - \frac{4 (x^2 + y^2)}{d_0^2}} \left(a_0 + \frac{a_1 (x^2 + y^2)}{d_0^2} + \frac{a_2 (x^2 + y^2)^2}{d_0^4}\right) == 0, \{x, y\}, , \text{Reals}\right]$$

... Reduce: Reduce was unable to solve the system with inexact coefficients. The answer was obtained by solving a corresponding exact system and numericizing the result.

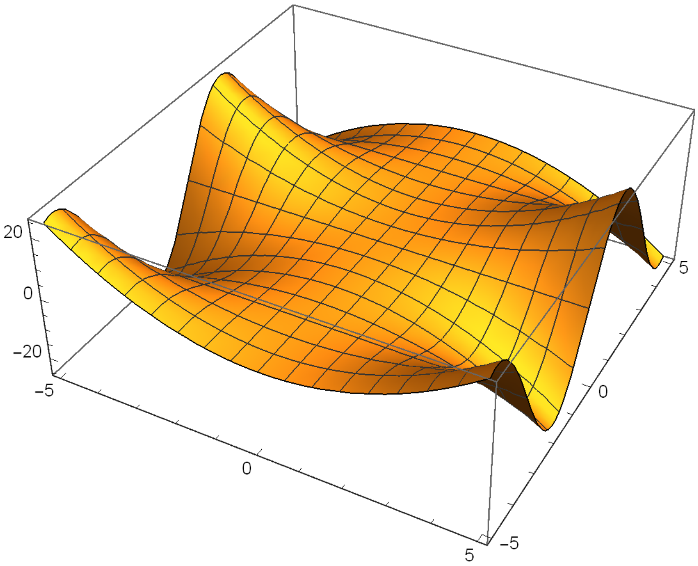
Out[∘]= $-3.91 \le x \le 3.91 \,\&\&\, \left(y == -0.01 \sqrt{152881. - 10000.\, x^2} \;||\; y == 0.01 \sqrt{152881. - 10000.\, x^2}\right)$

In[∘]:=
$$\text{NIntegrate}\Big[1, \{x, -3.91, 3.91\},$$
$$\{y, -0.01\text{`} \sqrt{152881.\text{`} - 10000.\text{`}\, x^2}, 0.01\text{`} \sqrt{152881.\text{`} - 10000.\text{`}\, x^2}\},$$
$$\Big\{z, -d_0 \sqrt{1 - \frac{4 (x^2 + y^2)}{d_0^2}} \left(a_0 + \frac{a_1 (x^2 + y^2)}{d_0^2} + \frac{a_2 (x^2 + y^2)^2}{d_0^4}\right),$$
$$d_0 \sqrt{1 - \frac{4 (x^2 + y^2)}{d_0^2}} \left(a_0 + \frac{a_1 (x^2 + y^2)}{d_0^2} + \frac{a_2 (x^2 + y^2)^2}{d_0^4}\right)\Big\}\Big]$$

Out[∘]= 94.0984

In[∘]:=
```
(* 10.01 Task1 *)
N[Log[485] + √53]
```
Out[∘]= 13.4643

In[∘]:=
```
(* Task2 *)
Plot3D[x^2 Sin[y], {x, -5, 5}, {y, -5, 5}]
```
Out[∘]=



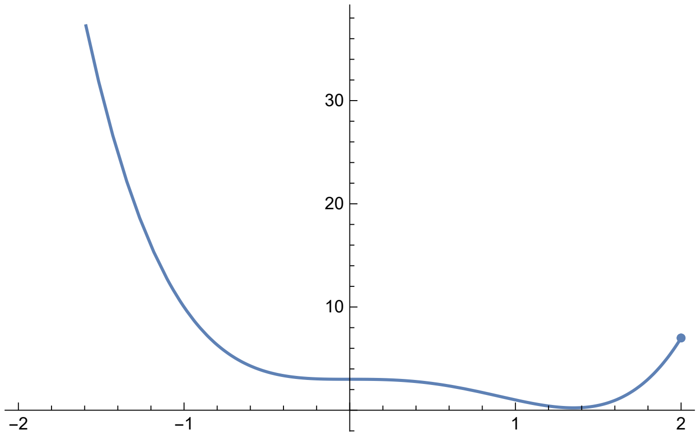
In[∘]:=
```
(* Task3 *)
taylorPoly[f_, n_, x0_] := Sum[((D[f, {x, i}] /. x → x0) / i!) * (x - x0)^i, {i, 0, n}];
Print[taylorPoly[x^3 - 3 x^2 - 3 ArcTan[x] + 4, 4, 1.5]]
```
$-2.32338 - 3.17308\,(-1.5 + x) + 1.92604\,(-1.5 + x)^2 + 0.832499\,(-1.5 + x)^3 + 0.0504184\,(-1.5 + x)^4$

In[∘]:=
```
(* Task 4 *)
NIntegrate[Cos[x] / √(x^2 + 1), {x, 0, 0.5}]
```
Out[∘]= 0.461999

In[∘]:=
```
Integrate[taylorPoly[Cos[x], 7, 0] / taylorPoly[√(x^2 + 1), 7, 0], {x, 0, 0.5}]
```
Out[∘]= 0.461994

```
(* Task 5 *)
Clear[a]
NSolve[a 2^4 - (a + 2) 2^3 + 3 == 7, a]
```
Out[∘]= {{a → 2.5}}

In[∘]:=
```
a = 2.5;
Show[Plot[a x^4 - (a + 2) x^3 + 3, {x, -2, 2}], ListPlot[{{2, 7}}]]
```

Out[∘]=


In[∘]:=
```
(* Task 6 *)
Clear[n]
f[n_] := (
  For[k = 2, k <= n, k++,
   If[Det[Table[i - j^2, {i, k}, {j, k}]] == 0, Print["Yes"], Print["No"]]]
 )
```

In[∘]:=
```
f[10]
```

No

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

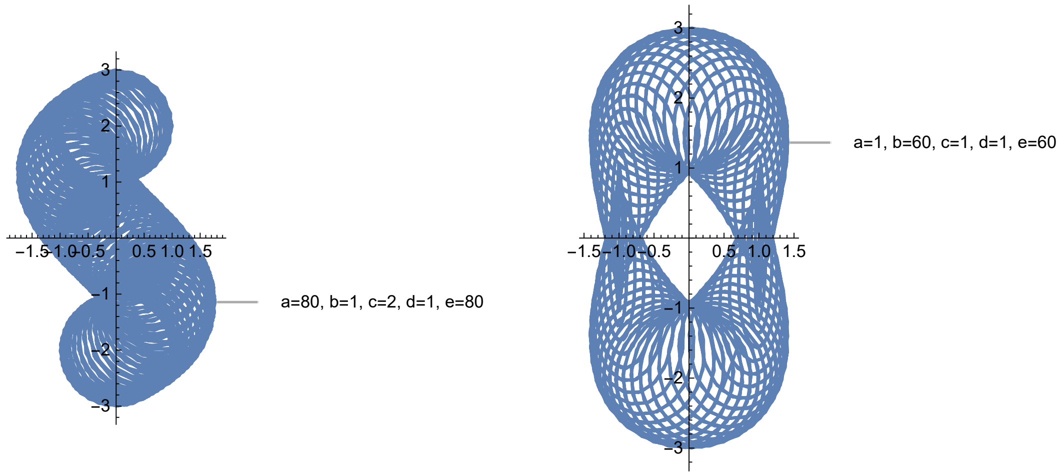
In[∘]:=
```
(* Task 7 *)
Clear[x, y, t, a, b, c, d, e]
x[t_] := Cos[a t] - Cos[b t] Sin[c t];
y[t_] := 2 Sin[d t] - Sin[e t];
```

In[∘]:=
```
(* a *)
a = 80;
b = 1;
c = 2;
d = 1;
e = 80;
g1 =
  ParametricPlot[{x[t], y[t]}, {t, -10, 10}, PlotLabels → "a=80, b=1, c=2, d=1, e=80"];
```

In[∘]:=
```
(* b *)
Clear[a, b, c, d, e]
a = 1;
b = 60;
c = 1;
d = 1;
e = 60;
g2 =
  ParametricPlot[{x[t], y[t]}, {t, -10, 10}, PlotLabels → "a=1, b=60, c=1, d=1, e=60"];
```

In[∘]:=
```
GraphicsRow[{g1, g2}]
```

Out[∘]=



In[∘]:=
```
(* Task 8 *)
Clear[list]
list = Table[RandomInteger[{1, 100}], {i, 1000}];
list1 = {};
For[i = 1, i ≤ Length[list], i++,
 If[EvenQ[list[[i]]], AppendTo[list1, list[[i]]]]]
```

In[∘]:=
```
(* Task 9 *)
Clear[f, g, x]
f[x_] := Sin[x];
g[x_] := (f[x + Δx] - f[x])/Δx;
Limit[g[x], Δx → 0]
```

Out[∘]= Cos[x]

In[∘]:=
```
D[f[x], x]
```

Out[∘]= Cos[x]

In[∘]:=
```
Manipulate[
 Plot[{(f[x + Δx] - f[x])/Δx, Cos[x]}, {x, -10, 10}, PlotRange → {-1, 1}], {Δx, -5, 0}]
```

Out[∘]=

In[∘]:=
```
(*Manipulate[GraphicsRow[{Plot[{f[x], (f[x+Δx]-f[x])/Δx},{x,-10,10},PlotRange→{-1,1}],
  Plot[Abs[f[x]-(f[x+Δx]-f[x])/Δx],{x,-10,10}]}],{Δx,-5,0}]*)
```

In[∘]:=
```
(* Task 10 *)
FindRoot[{y == e^(x-2), y^2 == x}, {x, 1}, {y, 1}]
```

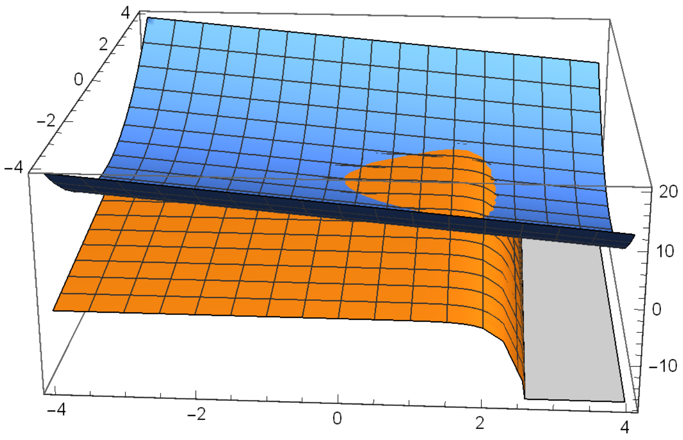
Out[∘]= {x → 0.019026, y → 0.137935}

In[∘]:=
```
NSolve[{y == e^(x-2), y^2 == x}, {x, y}, Reals]
```

Out[∘]= {{x → 0.019026, y → 0.137935}, {x → 2.44754, y → 1.56446}}

In[∘]:= Plot3D[{y == e^(x-2), y^2 == x}, {x, -4, 4}, {y, -4, 4}]

Out[∘]=



In[∘]:=
```
(* Task 11 *)
Clear[f, x]
```
$$f[x\_] := \mathrm{Det}\left[\begin{pmatrix} 2 & x & x^2 & x^3 \\ x & 0 & x & x^2 \\ x^2 & x & 1 & x \\ x^3 & x^2 & x & 4 \end{pmatrix}\right];$$
```
FindMinimum[{f[x], 0 ≤ x ≤ 2016}, x]
```

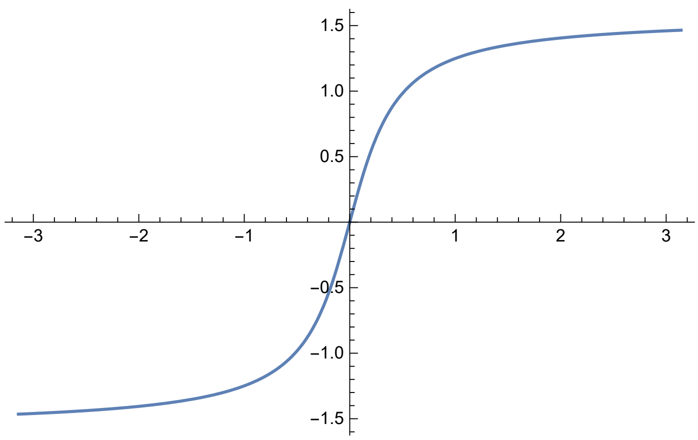
Out[∘]= {-3.7037, {x → 0.816497}}

In[∘]:= FindMaximum[{f[x], 0 ≤ x ≤ 2016}, x]

Out[∘]= {9., {x → 1.73205}}

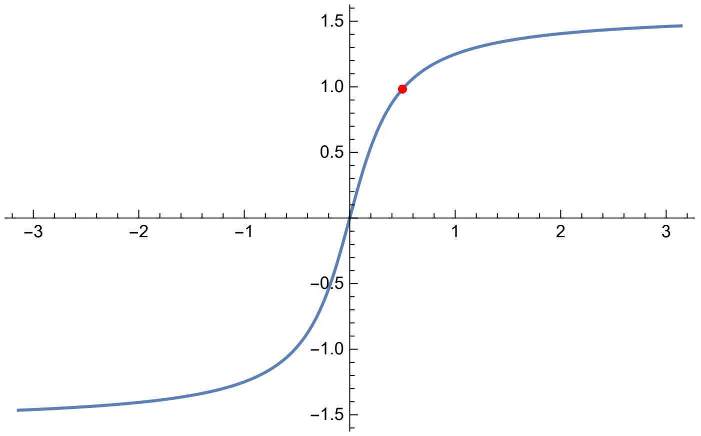
In[∘]:=
```
(* Task 12 *)
Clear[f, x]
f[x_] := ArcTan[3 x];
(* a *)
Plot[f[x], {x, -π, π}]
```

Out[∘]=



In[]:=
```
(* b *)
Show[{Plot[f[x], {x, -π, π}], ListPlot[{{0.5, f[0.5]}}, PlotStyle → Red]}]
```

Out[]=

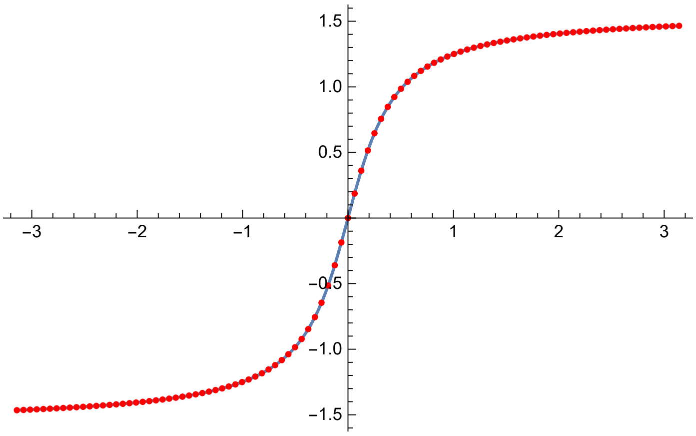


In[]:=
```
(* c *)
Clear[M]
M = Table[{x_i, f[x_i]}, {x_i, -π, π, 2π/100.}]
```

Out[]=
```
{{-3.14159, -1.46509}, {-3.07876, -1.46295}, {-3.01593, -1.46072},
 {-2.9531, -1.4584}, {-2.89027, -1.45597}, {-2.82743, -1.45345}, {-2.7646, -1.4508},
 {-2.70177, -1.44804}, {-2.63894, -1.44515}, {-2.57611, -1.44212},
 {-2.51327, -1.43894}, {-2.45044, -1.4356}, {-2.38761, -1.43208},
 {-2.32478, -1.42838}, {-2.26195, -1.42448}, {-2.19911, -1.42037},
 {-2.13628, -1.41601}, {-2.07345, -1.4114}, {-2.01062, -1.4065}, {-1.94779, -1.4013},
 {-1.88496, -1.39577}, {-1.82212, -1.38986}, {-1.75929, -1.38355},
 {-1.69646, -1.37678}, {-1.63363, -1.36951}, {-1.5708, -1.36169},
 {-1.50796, -1.35325}, {-1.44513, -1.3441}, {-1.3823, -1.33417},
 {-1.31947, -1.32335}, {-1.25664, -1.31151}, {-1.19381, -1.29851},
 {-1.13097, -1.28418}, {-1.06814, -1.2683}, {-1.00531, -1.25063},
 {-0.942478, -1.23085}, {-0.879646, -1.20858}, {-0.816814, -1.18334},
 {-0.753982, -1.15453}, {-0.69115, -1.12142}, {-0.628319, -1.08303},
 {-0.565487, -1.03816}, {-0.502655, -0.985235}, {-0.439823, -0.922271},
 {-0.376991, -0.846783}, {-0.314159, -0.755794}, {-0.251327, -0.646045},
 {-0.188496, -0.514655}, {-0.125664, -0.360515}, {-0.0628319, -0.18631},
 {4.44089×10^-16, 1.33227×10^-15}, {0.0628319, 0.18631}, {0.125664, 0.360515},
 {0.188496, 0.514655}, {0.251327, 0.646045}, {0.314159, 0.755794}, {0.376991, 0.846783},
 {0.439823, 0.922271}, {0.502655, 0.985235}, {0.565487, 1.03816}, {0.628319, 1.08303},
 {0.69115, 1.12142}, {0.753982, 1.15453}, {0.816814, 1.18334}, {0.879646, 1.20858},
 {0.942478, 1.23085}, {1.00531, 1.25063}, {1.06814, 1.2683}, {1.13097, 1.28418},
 {1.19381, 1.29851}, {1.25664, 1.31151}, {1.31947, 1.32335}, {1.3823, 1.33417},
 {1.44513, 1.3441}, {1.50796, 1.35325}, {1.5708, 1.36169}, {1.63363, 1.36951},
 {1.69646, 1.37678}, {1.75929, 1.38355}, {1.82212, 1.38986}, {1.88496, 1.39577},
 {1.94779, 1.4013}, {2.01062, 1.4065}, {2.07345, 1.4114}, {2.13628, 1.41601},
 {2.19911, 1.42037}, {2.26195, 1.42448}, {2.32478, 1.42838}, {2.38761, 1.43208},
 {2.45044, 1.4356}, {2.51327, 1.43894}, {2.57611, 1.44212}, {2.63894, 1.44515},
 {2.70177, 1.44804}, {2.7646, 1.4508}, {2.82743, 1.45345}, {2.89027, 1.45597},
 {2.9531, 1.4584}, {3.01593, 1.46072}, {3.07876, 1.46295}, {3.14159, 1.46509}}
```

In[∘]:=
```
(* d *)
Show[{Plot[f[x], {x, -π, π}], ListPlot[{M}, PlotStyle → Red]}]
```

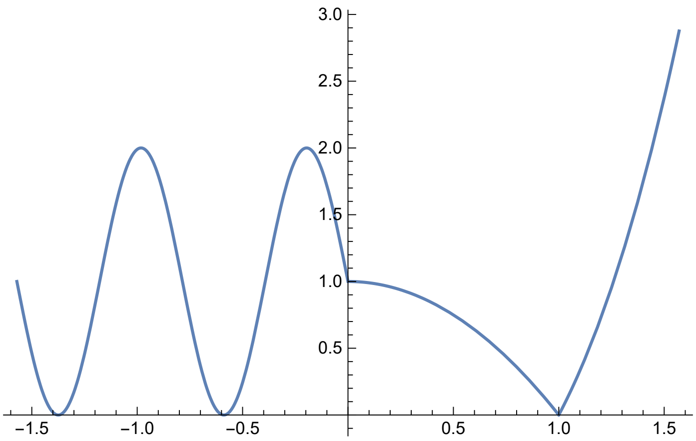
Out[∘]=



In[∘]:=
```
(* Task 13 *)
Clear[f]
f[x_] := { 1 - Sin[8 x]   x < 0
         { 1 - x^2        0 ≤ x ≤ 1;
         { x^3 - 1        1 ≤ x
```

In[∘]:=
```
Plot[f[x], {x, -π/2, π/2}]
```

Out[∘]=



In[∘]:=
```
Minimize[f[x], x]
```

Out[∘]= {0, {x → 1}}

In[∘]:=
```
NMaximize[{f[x], -π/2 ≤ x ≤ π/2}, x]
```

Out[∘]= {2.87578, {x → 1.5708}}

In[∘]:=
```
(* Task 14 *)
Clear[f, x, k, M]
k = 4 x^3 - 3 Sqrt[x];
M = {1, 0};

Integrate[k, x]
```

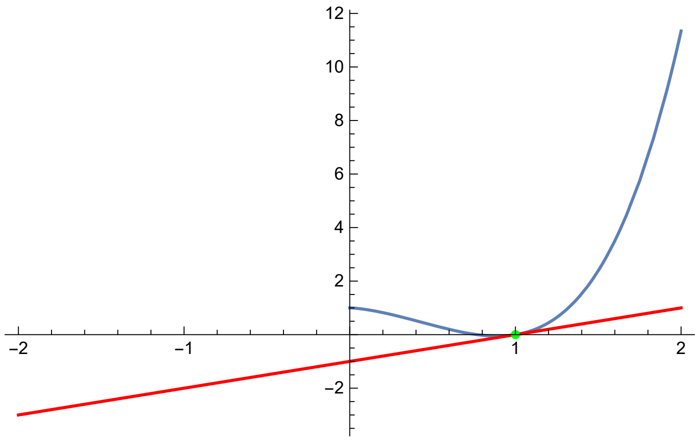
Out[∘]= $-2\,x^{3/2} + x^4$

In[ ]:=
```
Solve[y == x^4 - 2 x^(3/2) + c /. {x → 1, y → 0}, c]
```
Out[ ]= {{c → 1}}

In[ ]:=
```
f[x_] := x^4 - 2 x^(3/2) + 1;
Solve[0 == f'[1] 1 + b, b]
```
Out[ ]= {{b → -1}}

In[ ]:=
```
f'[1]
```
Out[ ]= 1

In[ ]:=
```
Show[{Plot[f[x], {x, -2, 2}, PlotRange → All],
  Plot[x - 1, {x, -2, 2}, PlotStyle → Red], ListPlot[{{M}}, PlotStyle → Green]}]
```
Out[ ]=



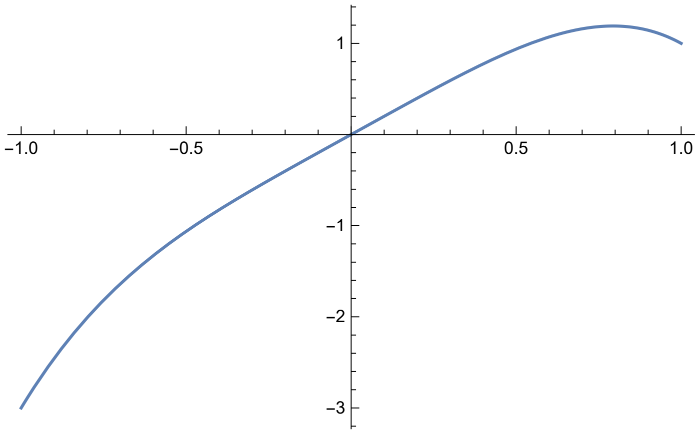
In[ ]:=
```
(* Task 15 *)
Clear[t, A, x, a]
f[t_] := Det[Table[Integrate[(Cos[x] + Sin[x])/(i + j), {x, π/4, t}], {i, 3}, {j, 3}]];
Series[f[t], {t, 0, 10}]
```
Out[ ]=
$$-\frac{1}{43200}+\frac{t}{14400}-\frac{t^2}{28800}-\frac{t^3}{17280}+\frac{13\,t^4}{345600}+\frac{41\,t^5}{1728000}-\frac{121\,t^6}{10368000}-\frac{73\,t^7}{14515200}+\frac{1093\,t^8}{580608000}+\frac{3281\,t^9}{5225472000}-\frac{9841\,t^{10}}{52254720000}+O[t]^{11}$$

In[ ]:=
```
(* Task 16 *)
Clear[f, x, x0, Δx, M, a, b]
f[x_] := -x^4 + 2 x;
x0 = 1;
M = {x0, f[x0]};
```

In[ ]:=
```
f'[x]
```
Out[ ]= $2 - 4 x^3$

In[ ]:=
```
Plot[f[x], {x, -1, 1}]
```

Out[ ]=



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

Out[ ]= 1

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

Out[ ]= −2

In[ ]:=
```
Solve[f[f[x0]] == f'[x0] x0 + b, b]
```

Out[ ]= {{b → 3}}

In[ ]:=
```
Solve[{a x0 + b == f[x0], a (x0 + Δx) + b == f[x0 + Δx]}, {a, b}]
```

Out[ ]= $\{\{a \to -2 - 6\,\Delta x - 4\,\Delta x^2 - \Delta x^3,\ b \to 3 + 6\,\Delta x + 4\,\Delta x^2 + \Delta x^3\}\}$

In[ ]:=
```
Manipulate[
 Show[Plot[f[x], {x, -3.5, 3.5}, PlotRange → Full, PlotLabels → "f[x]"], Plot[x + 3, {x,
    -3.5, 3.5}, PlotLabels → "f'[x]"],
  Plot[(-2 - 6 Δx - 4 Δx^2 - Δx^3) x + (3 + 6 Δx + 4 Δx^2 + Δx),
   {x, -3.5, 3.5}, PlotLabels → "sec"]], {Δx, 1, 0}]
```

Out[ ]=