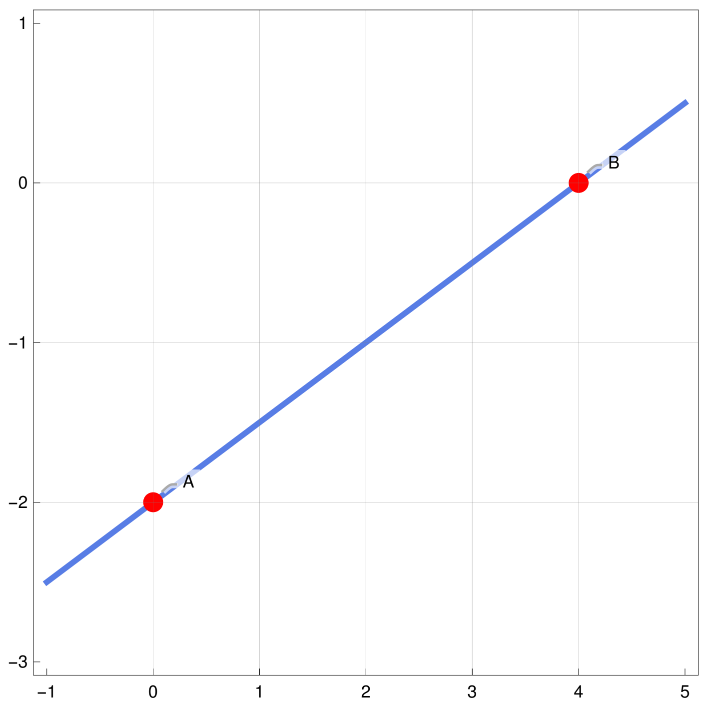
Problem 4.4.

In[11]:=
```
Show[
 ContourPlot[2 y - x + 4 == 0, {x, -1, 5},
  {y, -3, 1}, PlotTheme → "Business", GridLines → Automatic],
 ListPlot[{{0, -2}, {4, 0}} → {"A", "B"}, PlotStyle → Directive[Red, PointSize[0.03]]]
]
```

Out[11]=



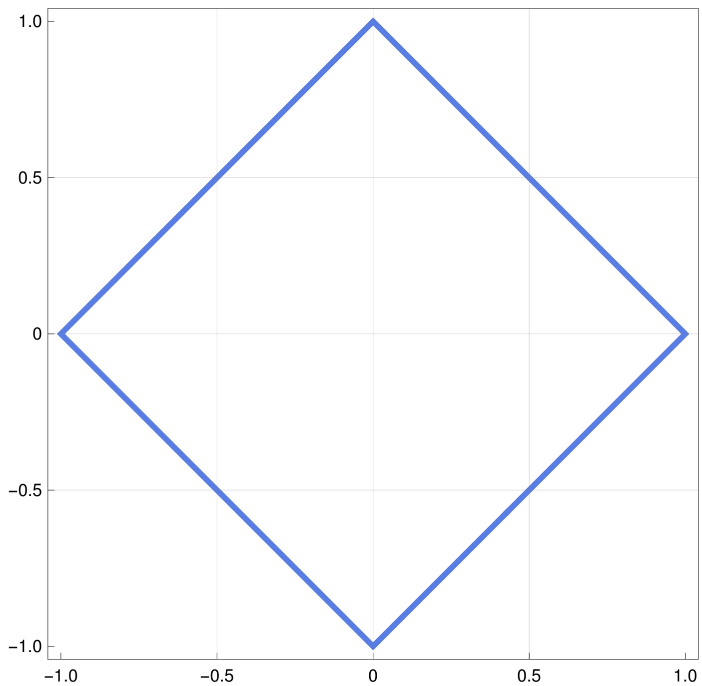
In[7]:=
```
x[t_] = 2 t + 4; y[t_] = t;
Integrate[1/Sqrt[x[t]^2 + y[t]^2] Sqrt[D[x[t], t]^2 + D[y[t], t]^2], {t, -2, 0}]
```

Out[8]= $\text{Log}\left[\frac{1}{2}\left(7+3\sqrt{5}\right)\right]$

Problem 4.7.

In[10]:=
```
ContourPlot[Abs[x] + Abs[y] == 1, {x, -1, 1},
 {y, -1, 1}, PlotTheme → "Business", GridLines → Automatic]
```

Out[10]=



Problem 4.26.

In[18]:=
```
α = ArcCos[1/Sqrt[3]];
β = Pi/4;
R1[θ_] = {{Cos[θ], -Sin[θ], 0}, {Sin[θ], Cos[θ], 0}, {0, 0, 1}};
R2[θ_] = {{Cos[-θ], 0, -Sin[-θ]}, {0, 1, 0}, {Sin[-θ], 0, Cos[-θ]}};
R1[α] // MatrixForm
R2[β] // MatrixForm
```

Out[22]//MatrixForm=

$$\begin{pmatrix} \frac{1}{\sqrt{3}} & -\sqrt{\frac{2}{3}} & 0 \\ \sqrt{\frac{2}{3}} & \frac{1}{\sqrt{3}} & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

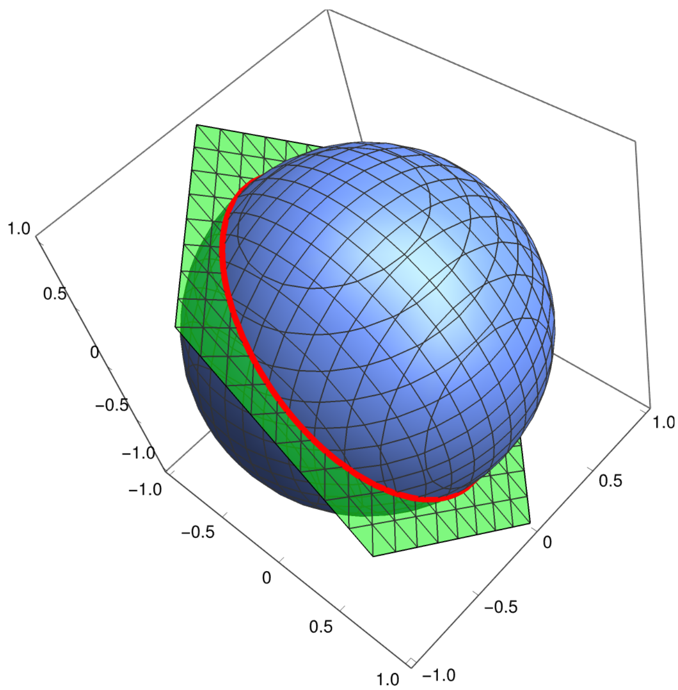
Out[23]//MatrixForm=

$$\begin{pmatrix} \frac{1}{\sqrt{2}} & 0 & \frac{1}{\sqrt{2}} \\ 0 & 1 & 0 \\ -\frac{1}{\sqrt{2}} & 0 & \frac{1}{\sqrt{2}} \end{pmatrix}$$

In[55]:=
```
r[t_] = R1[β].R2[α].{Cos[t], Sin[t], 0};
Print["Vector normal of circle is ", R1[β].R2[α].{0, 0, 1}]
Print["Radius-vector function is ", r[t]]
Show[
 ContourPlot3D[x^2 + y^2 + z^2 == 1, {x, -1, 1}, {y, -1, 1}, {z, -1, 1}, PlotTheme → "Business"],
 ContourPlot3D[x + y + z == 0, {x, -1, 1}, {y, -1, 1},
  {z, -1, 1}, ContourStyle → Directive[Green, Opacity[0.5]]],
 ParametricPlot3D[r[t], {t, 0, 2 Pi}, PlotStyle → Directive[Red, Thickness[0.01]]]
]
```

Vector normal of circle is $\left\{\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right\}$

Radius-vector function is $\left\{\frac{\mathrm{Cos}[t]}{\sqrt{6}} - \frac{\mathrm{Sin}[t]}{\sqrt{2}}, \frac{\mathrm{Cos}[t]}{\sqrt{6}} + \frac{\mathrm{Sin}[t]}{\sqrt{2}}, -\sqrt{\frac{2}{3}}\,\mathrm{Cos}[t]\right\}$

Out[58]=


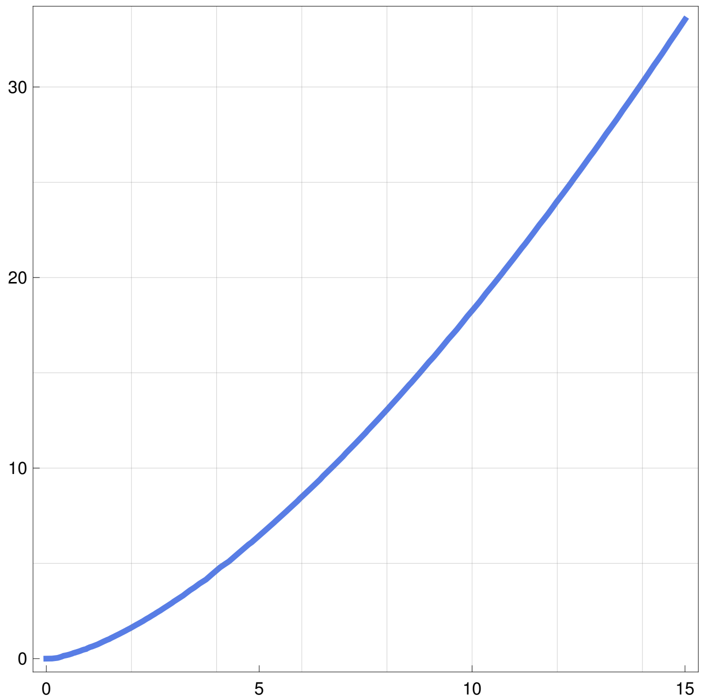
In[59]:=
```
Integrate[r[t][[1]]^2 Sqrt[D[r[t], t].D[r[t], t]], {t, 0, 2 Pi}]
```

Out[59]= $\frac{2\pi}{3}$

Problem 5.1.

In[63]:=
```
Clear[a];
a = 3.0;
ContourPlot[a y^2 == x^3, {x, 0, 5 a}, {y, 0, Sqrt[(5 a)^3/a]},
 PlotTheme → "Business", GridLines → Automatic]
```

Out[65]=



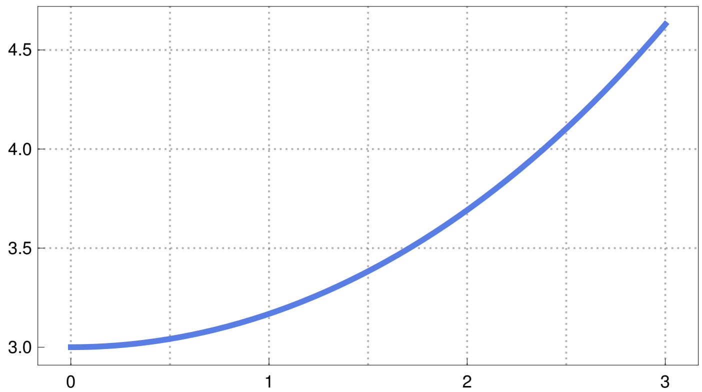
In[68]:=
```
Clear[a];
x[t_] = t; y[t_] = t^(3/2)/Sqrt[a];
Integrate[Sqrt[D[x[t], t]^2 + D[y[t], t]^2], {t, 0, 5 a}]
```

Out[70]= $\frac{335\,a}{27}$

Problem 5.2.

In[84]:=
```
Clear[x, y, a];
a = 3.0;
x[t_] = t; y[t_] = a/2 (Exp[t/a] + Exp[-t/a]);
ParametricPlot[{x[t], y[t]}, {t, 0, 3}, PlotTheme → "Business", GridLines → Automatic]
```

Out[87]=



In[93]:=
```
Clear[a];
x[t_] = t; y[t_] = a/2 (Exp[t/a] + Exp[-t/a]);
Assuming[x0 > 0 && a > 0, Integrate[Sqrt[D[x[t], t]^2 + D[y[t], t]^2], {t, 0, x0}]]
```

Out[95]= $a \operatorname{Sinh}\left[\frac{x0}{a}\right]$