Compute curvature of smooth curve using Mathematica

In[ ]:=
```
curvature[r0_] := Module[{r = r0}, v = D[r, t]; T = v/Sqrt[v.v];
  κ = Simplify[Sqrt[(1/Sqrt[v.v] * D[T, t]).(1/Sqrt[v.v] * D[T, t])]]]
```

In[ ]:=
```
r = {Cos[t], Sin[t]};
```

In[ ]:=
```
curvature[r]
```

Out[ ]=
```
1
```

In[ ]:=
```
r = {2 Cos[t], 2 Sin[t]}
curvature[r]
```

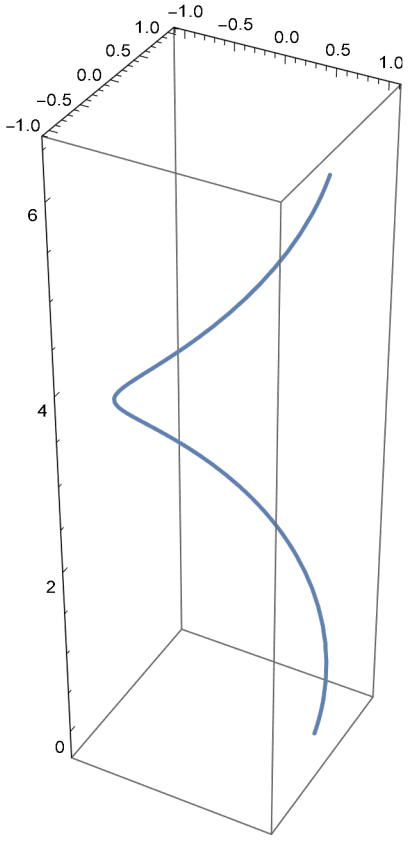
Out[ ]=
```
{2 Cos[t], 2 Sin[t]}
```

Out[ ]=
$$\frac{1}{2}$$

In[ ]:=
```
r = {Cos[t], Sin[t], t};
```

In[ ]:=
```
ParametricPlot3D[r, {t, 0, 2 Pi}]
```

Out[ ]=



In[ ]:=
```
r = {t - Cos[t], 1 - Sin[t]}
```

Out[ ]=
```
{t - Cos[t], 1 - Sin[t]}
```

In[ ]:= curvature[r]

Out[ ]= $\frac{1}{2}\sqrt{\frac{1}{2+2\,\text{Sin}[t]}}$

In[ ]:= f[t_] := $\frac{1}{2}\sqrt{\frac{1}{2+2\,\text{Sin}[t]}}$

In[ ]:= f[0]

Out[ ]= $\frac{1}{2\sqrt{2}}$

In[ ]:= $f\left[\frac{\text{Pi}}{4}\right]$

Out[ ]= $\frac{1}{2\sqrt{2+\sqrt{2}}}$

In[ ]:= ParametricPlot[r, {t, 0, 5 Pi}]

Out[ ]=