V (r) = k*r^(n + 1)

```
v[u_] := k / u ^ (n + 1)
```

```
k = 10
```

```
10
```

```
l = 3
```

```
3
```

```
mu = 1
```

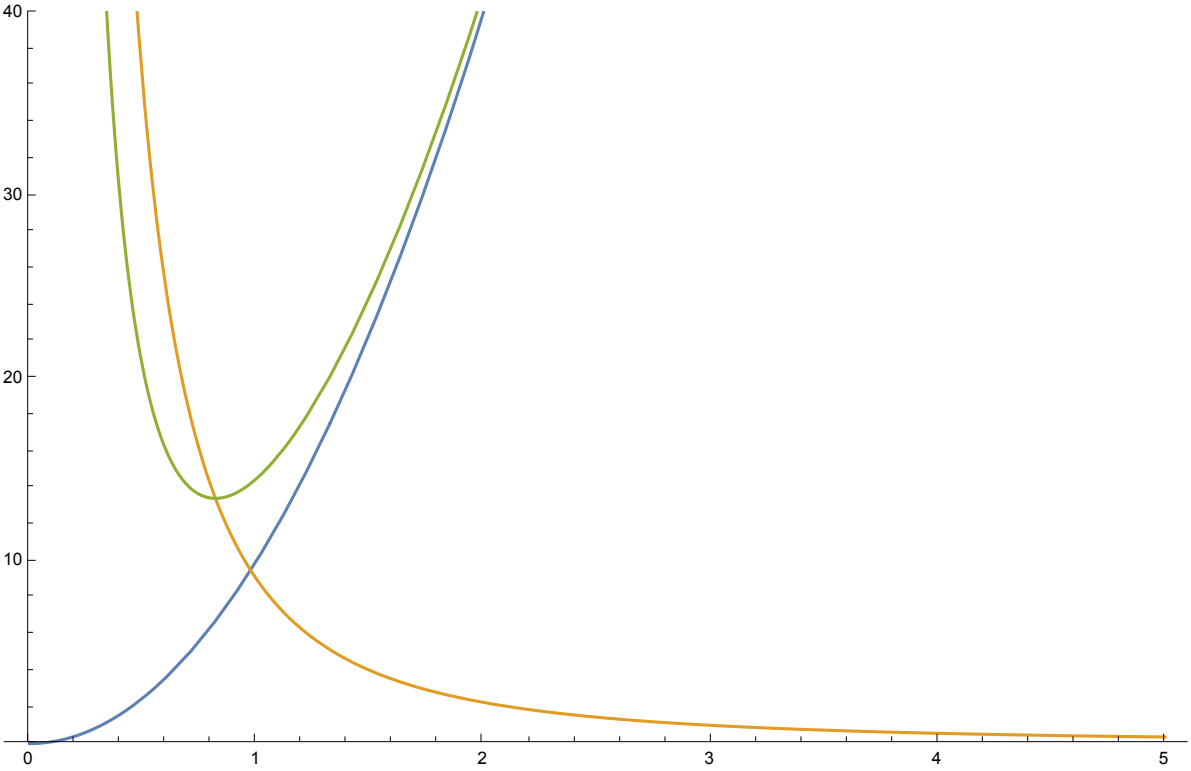
```
1
```

```
n = 1
```

```
1
```

```
fakev[u_] := l ^ 2 / 2 / mu * u ^ 2 + v[u]
```

```
Plot[{v[1 / r], l ^ 2 / mu / r ^ 2, fakev[1 / r]}, {r, 0, 5}, PlotRange → {0, 40}]
```




```
uequi = NSolve[fakev'[uu] == 0, uu, Reals]
```

```
{{uu → -1.22095}, {uu → 1.22095}}
```

```
requi = 1 / uu /. uequi
```

```
{-0.819036, 0.819036}
```

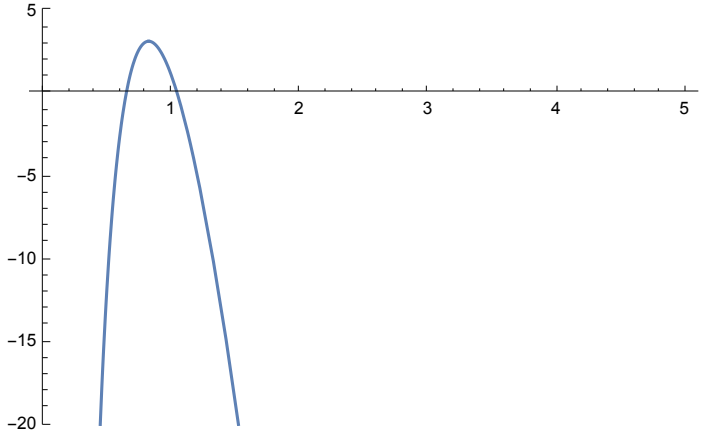
```
fakev[uu] /. uequi
```

```
{13.4164, 13.4164}
```

```
e = 15
```

```
15
```

```
Plot[2 * mu * e - l^2 / r^2 - 2 * mu * v[1 / r], {r, 0, 5}, PlotRange → {-20, 5}]
```




```
utp = NSolve[2 * mu * e - l^2 / r^2 - 2 * mu * v[1 / r] == 0, r, Reals]
```

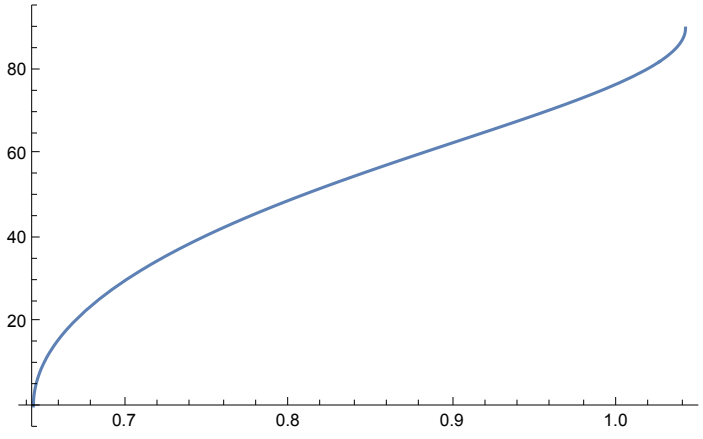
```
{{r → -1.04183}, {r → -0.643886}, {r → 0.643886}, {r → 1.04183}}
```

```
theta[rmax_] := l * Integrate[
   1 / Sqrt[2 * mu * e - l^2 * uu^2 - 2 * mu * v[uu]], {uu, 1 / rmax, 1 / 0.6438864832989055}]
```

```
theta[1] * 180 / Pi
```

```
76.7175
```

```
Plot[180 / Pi * theta[rm], {rm, 0.6438864832989055, 1.041830214874270}]
```



```
ParametricPlot[{{rm * Cos[theta[rm]], rm * Sin[theta[rm]]},
  {rm * Cos[Pi - theta[rm]], rm * Sin[Pi - theta[rm]]},
  {rm * Cos[Pi + theta[rm]], rm * Sin[Pi + theta[rm]]},
  {rm * Cos[-theta[rm]], rm * Sin[-theta[rm]]}},
 {rm, 0.6438864832989055, 1.0418302148742 70}]
```