PART 2: Maple Tips

Don't forget to assign numerical values to \(a\) and \(g\) before attempting the calculations in parts 2c and 2d.

\[
> a:=1; \quad g:=9.8;
\]

\[
\begin{align*}
a &:= 1 \\
g &:= 9.8
\end{align*}
\]

2c. Here is what the first circle calculation might look like. [This is the circle that has its center on the line \(x = \pi\).]

\[
> y := (1-Pi^2/4)+sqrt((1+Pi^2/4)^2-(x-Pi)^2);
\]

\[
y := 1 - \frac{1}{4}\pi^2 + \sqrt{\left(1 + \frac{1}{4}\pi^2\right)^2 - (x - \pi)^2}
\]

\[
> \text{plot}(y, x=0..Pi);
\]

Here is the calculation of the integrand \((dTime)\).

\[
> yp := \text{diff}(y,x);
\]

\[
yp := \frac{1}{2} \frac{-2 x + 2 \pi}{\sqrt{\left(1 + \frac{1}{4}\pi^2\right)^2 - (x - \pi)^2}}
\]

\[
> dTime := \sqrt{(1+yp^2)/(2*g*y)};
\]

\[
dTime := \sqrt{\text{.05102040815 + .01275510204 \left(\frac{-2 x + 2 \pi}{1 + \frac{1}{4}\pi^2}\right)^2 - (x - \pi)^2}} \quad \frac{-2 x + 2 \pi}{1 - \frac{1}{4}\pi^2 + \sqrt{\left(1 + \frac{1}{4}\pi^2\right)^2 - (x - \pi)^2}}
\]

The integration itself may take some time. Be prepared to wait (perhaps for a minute or more). If you get an "out of memory" message, quit and then allocate more memory to Maple before relaunching and trying it again.

\[
> \text{Circle1Time} := \text{evalf(int(dTime, x=0..Pi))};
\]

\[
Circle1Time := 1.015444865
\]
At this point it is a good idea to "unassign" the variable $y$.

```maple
> y := 'y';
```

$b$.

If you take some pains to set things up carefully, the exploratory calculations required in this part can be very efficiently implemented.

```maple
> f := x -> S*x-((S*Pi-2)/Pi^2)*x^2;
```

The function $f$ corresponds to the parabolic arc through O and B which has slope $S$ at the point O. Here is the $dT$ calculation for this curve.

```maple
> fp := D(f);
```

Now it is easy (just be patient) to compute the integral for various values of $S$. For example:

```maple
> S:=1; Time := evalf(int(dT,x=0..Pi)); plot(f,0..Pi);
```

$S := 1$

$Time := 1.082497306$