

Sine Calculator--Teacher's Edition

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Choose a value  $x_1$  (give an exact value--no decimals).

Choose an epsilon.

Choose  $d$ , the number of decimals to be displayed.

```

x1 = 2
epsilon = 2 / 10 000;
d = 10;
x2 = Mod[x1, 2 π];
If[x2 > π, sign = -1, sign = 1];
x3 = Mod[x2, π];
x4 = Min[x3, π - x3];
n = 0;
While[ $\frac{(\pi/2)^{(n+1)}}{(n+1)!} > \text{epsilon}, n = n + 1]$ 

$$\frac{(\pi/2)^{(n)}}{n!} // \mathbf{N}$$

epsilon //  $\mathbf{N}$ 

$$\frac{(\pi/2)^{(n+1)}}{(n+1)!} // \mathbf{N}$$

f[x_] := Sin[x]
p[t_] :=  $\sum_{k=0}^n \frac{\text{Derivative}[k][f][0]}{k!} t^k$ 
p[t]
N[sign * p[x4], d]
N[Sin[x1], d]
Abs[N[sign * p[x4] - Sin[x1], d]]

2

0.00091926

0.0002

0.000160441


$$t - \frac{t^3}{6} + \frac{t^5}{120} - \frac{t^7}{5040}$$


0.9092884586

0.9092974268

 $8.968186327 \times 10^{-6}$ 

```

```
Table[{n,  $\frac{(\pi/2)^{(n+1)}}{(n+1)!}$  // N}, {n, 1, 10}] // TableForm
```

1	1.2337
2	0.645964
3	0.25367
4	0.0796926
5	0.0208635
6	0.00468175
7	0.00091926
8	0.000160441
9	0.000025202
10	$3.59884 \times 10^{-6}$