Solve $x = \cos(x)$ using Newton's method.

We iterate using the equation

$$x \leftarrow x - \frac{r(x)}{r'(x)},$$

where

$$r(x) = x - \cos(x) \quad \text{and} \quad r'(x) = 1 + \sin(x).$$

The results of the iteration with an initial guess of 0.0:

Iteration 0: $x = 0$, $r(x) = -1$

Iteration 1: $x = 1$, $r(x) = 0.4596976941318603$

Iteration 2: $x = 0.7503638678402438$, $r(x) = 0.0189230738221173$

Iteration 3: $x = 0.7391128909113616$, $r(x) = 0.0000464558989907$

Iteration 4: $x = 0.739085133385284$, $r(x) = 0.0000000002847205$

Iteration 5: $x = 0.7390851332151606$, $r(x) = -0.0000000000000001$

And the approximate answer is 0.7390851332151606.

The results of the iteration with an initial guess of 3.5:

Iteration 0: $x = 3.5$, $r(x) = 4.436456687290796$

Iteration 1: $x = -3.333552176267246$, $r(x) = -2.351919899515218$

Iteration 2: $x = -1.358448137289746$, $r(x) = -1.56920406223189$

Iteration 3: $x = 68.50416613568701$, $r(x) = 67.68501810937292$

Iteration 4: $x = -90.22516944332269$, $r(x) = -89.58880286393789$

Iteration 5: $x = 301.654206491361$, $r(x) = 300.6560854677848$

Iteration 6: $x = 18.3567053634968$, $r(x) = 17.47571763425544$

Iteration 7: $x = -14.81280501228759$, $r(x) = -14.18740967623314$

Iteration 8: $x = 49.76584948429253$, $r(x) = 48.88809101946707$

Iteration 9: $x = -44.08788646534236$, $r(x) = -45.08231709095901$

Iteration 10: $x = 6.30555800892673$, $r(x) = 5.305808267379551$

Iteration 11: $x = 1.115847892322645$, $r(x) = 0.676431898405011$

Iteration 12: $x = 0.7595092151012976$, $r(x) = 0.0343351794278702$

Iteration 13: $x = 0.7391752825917977$, $r(x) = 0.0001508780843201$

Iteration 14: $x = 0.7390851350094565$, $r(x) = 0.0000000030029551$

Iteration 15: $x = 0.7390851332151607$, $r(x) = 0.0000000000000001$

And the approximate answer is 0.7390851332151607.