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(* Newton's Method *)
f[x_, a_] := x^2 - a;
nextterm[old_, a_] :=
  (old^2 + a) / (2 * old);
nextterm[2, 2]

$$\frac{3}{2}$$

previous = 2;
num = 3;
Print["We are finding ", Sqrt[num],
  " = ", SetAccuracy[Sqrt[num], 40]];
Print["Initial Guess: Term 0: ", previous,
  " = ", SetAccuracy[previous, 15]];
For[j = 1, j ≤ 5, j++,
  {
    Print[" "];
    previous = nextterm[previous, num];
    Print["Term ", j, ": ", previous,
      " = ", SetAccuracy[previous, 15]];
    Print["Difference to ",
      Sqrt[num], " = ", SetAccuracy[
        Abs[previous - Sqrt[num]], 40]];
  }];

```

We are finding $\sqrt{3} =$

1.7320508075688772935274463415058723669428

Initial Guess: Term 0: $2 = 2.0000000000000000$

$$\text{Term 1: } \frac{7}{4} = 1.7500000000000000$$

$$\text{Difference to } \sqrt{3} = \\ 0.017949192431122706472553658494127633057$$

$$\text{Term 2: } \frac{97}{56} = 1.73214285714286$$

$$\text{Difference to } \sqrt{3} = \\ 0.000092049573979849329696515636984775914$$

$$\text{Term 3: } \frac{18\,817}{10\,864} = 1.73205081001473$$

$$\text{Difference to } \sqrt{3} = \\ 2.445850246973290035519164451908 \times 10^{-9}$$

$$\text{Term 4: } \frac{708\,158\,977}{408\,855\,776} = 1.73205080756888$$

$$\text{Difference to } \sqrt{3} = \\ 1.726907604566299547292 \times 10^{-18}$$

$$\text{Term 5: } \frac{1\,002\,978\,273\,411\,373\,057}{579\,069\,776\,145\,402\,304} \\ = 1.73205080756888$$

Difference to $\sqrt{3} = 8.61 \times 10^{-37}$