```
> # Assume n is an integer.  For this excercise, let a(n) be a sequence of integers.
>
>
> # Define a(n) = a(n-1) + c·a(n-2).
> # as of 8-14-2017 values of c 1 to 11 inclusive are in OEIS.
> # where c are counting numbers.
> # case c=1
  sol1 := rsolve({a(1) = 1, a(2) = 2, a(n) = a(n - 1) + a(n - 2)}, a(k));
```

$$sol1 := \left(\frac{1}{10}\sqrt{5} + \frac{1}{2}\right)\left(\frac{1}{2} + \frac{1}{2}\sqrt{5}\right)^k + \left(-\frac{1}{10}\sqrt{5} + \frac{1}{2}\right)\left(\frac{1}{2} - \frac{1}{2}\sqrt{5}\right)^k \quad (1)$$

```
> seq1 := seq(round(sol1), k = 1 ..18);
```

$$seq1 := 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181 \quad (2)$$

```
> # a quick search of oeis.org reveals that this is A000045, the Fibonacci sequence.
> # case c=2
  sol2 := rsolve({a(1) = 1, a(2) = 2, a(n) = a(n - 1) + 2·a(n - 2)}, a(k));
```

$$sol2 := \frac{1}{2}\,2^k \quad (3)$$

```
> seq2 := seq(sol2, k = 1 ..18);
```

$$seq2 := 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 32768, 65536, 131072 \quad (4)$$

```
> # another oeis.org search reveals A000079, Powers of 2.
> # now a little procedure for arbitrary values a1, a2, and c
>
>
> rp := proc(a1, a2, c :: integer)
   description " show general form for input c";
   local soln, seqn;
   soln := rsolve({a(1) = a1, a(2) = a2, a(n) = a(n - 1) + c·a(n - 2)}, a(k));
  end proc;
```

$$rp := \mathbf{proc}(a1, a2, c::integer)$$
$$\quad \mathbf{local}\ soln, seqn;$$
$$\quad \mathbf{description}\ \text{" show general form for input c"};$$
$$\quad soln := rsolve(\{a(1) = a1, a(2) = a2, a(n) = a(n - 1) + c * a(n - 2)\}, a(k))$$
$$\mathbf{end\ proc} \quad (5)$$

```
> # case c=3
  sol3 := rp(1, 2, 3);
```

$$sol3 := \left(-\frac{5}{78}\sqrt{13} + \frac{1}{6}\right)\left(\frac{1}{2} - \frac{1}{2}\sqrt{13}\right)^k + \left(\frac{5}{78}\sqrt{13} + \frac{1}{6}\right)\left(\frac{1}{2} + \frac{1}{2}\sqrt{13}\right)^k \quad (6)$$

```
> seq3 := seq(round(sol3), k = 1 ..18);
```

$$seq3 := 1, 2, 5, 11, 26, 59, 137, 314, 725, 1667, 3842, 8843, 20369, 46898, 108005, 248699, 572714, 1318811 \quad (7)$$

```
> # another oeis.org search reveals A003168.  Note that a(1)=1 and a(2)=2 is assumed.
> # here 2,3,5,8,13,21 is a partial Fibonacci sequence.
> # work in progress.
> # case c=4
```

```
sol4 := rp(1, 2, 4);
```

$$sol4 := \left(\frac{7}{136}\sqrt{17}+\frac{1}{8}\right)\left(\frac{1}{2}+\frac{1}{2}\sqrt{17}\right)^{k}+\left(-\frac{7}{136}\sqrt{17}+\frac{1}{8}\right)\left(\frac{1}{2}-\frac{1}{2}\sqrt{17}\right)^{k} \quad \textbf{(8)}$$

```
> seq4 := seq(round(sol4), k = 1 ..18);
```

$$seq4 := 1, 2, 6, 14, 38, 94, 246, 622, 1606, 4094, 10518, 26894, 68966, 176542, 452406, 1158574, 2968198, 7602494 \quad \textbf{(9)}$$

```
> # I notice that the even numbers are not twice Fibonacci numbers.
>
```