

Exploring the World of Math

Name: _____ Date: _____

Powers of Phi

1. Write a Fibonacci sequence from 1 to 610

F ₁	F ₂	F ₃	F ₄	F ₅	F ₆	F ₇	F ₈	F ₉	F ₁₀	F ₁₁	F ₁₂	F ₁₃	F ₁₄	F ₁₅

2. Phi is equal to $\frac{1+\sqrt{5}}{2}$ which is $(1 + 2.236) \div 2 = 1.618$

3. What is Phi squared: $1.618^2 = 2.618$

Notice that $2.618 - 1.618$ is 1, so we use $\text{phi}^2 = \text{phi} + 1$

So we can say

$\text{Phi}^3 = \text{phi} (\text{phi})^2 = \text{phi} (\text{phi} + 1)$ $\text{Phi}^3 = \text{phi}^2 + \text{phi}$ $\text{Phi}^3 = (\text{phi} + 1) + \text{phi}$ $\text{Phi}^3 = 2\text{phi} + 1$	$\text{Phi}^4 = \text{phi} (\text{phi})^3 = \text{phi} (2\text{phi} + 1)$ $\text{Phi}^4 = 2\text{phi}^2 + \text{phi}$ $\text{Phi}^4 = 2(\text{phi} + 1) + \text{phi}$ $\text{Phi}^4 = 2\text{phi} + 2 + \text{phi} = 3\text{phi} + 2$
$\text{Phi}^5 = \text{phi} (\text{phi})^4 = \text{phi} (3\text{phi} + 2)$ $\text{Phi}^5 = 3\text{phi}^2 + 2\text{phi}$ $\text{Phi}^5 = 3(\text{phi} + 1) + 2\text{phi}$ $\text{Phi}^5 = 3\text{phi} + 3 + 2\text{phi} = 5\text{phi} + 3$	$\text{Phi}^6 = \text{phi} (\text{phi})^5 = \text{phi} (5\text{phi} + 3)$ $\text{Phi}^6 = 5\text{phi}^2 + 3\text{phi}$ $\text{Phi}^6 = 5(\text{phi} + 1) + 3\text{phi}$ $\text{Phi}^6 = 5\text{phi} + 5 + 3\text{phi} = 8\text{phi} + 5$
Compute Phi^7	Compute Phi^8
Compute Phi^9	Compute Phi^{10}

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Determining a Fibonacci Number

1. Compute $F_{10} = \text{phi}^{10} / \sqrt{5}$ or $F_{10} = (1.618)^{10} / 2.236 = 54.99$ and we round it to 55
2. Compute F_5
3. Compute F_7
4. Compute F_{12}
5. Compute F_{15}
6. Compute F_{17}
7. Compute F_{19}
8. Compute F_{20}
9. Compute F_{22}
10. Compute F_{25}

1	1
2	1
3	2
4	3
5	5
6	8
7	13
8	21
9	34
10	55
11	89
12	144
13	233
14	377
15	610
16	987
17	1597
18	2584
19	4181
20	6765
21	10946
22	17711
23	28657
24	46368
25	75025