Discussion Questions

- What's a simple rule to calculate
  $R_4(n)$ for any n? It's n, except it's 0 when multiples of 4
  $S_4(n)$ for any n? $S_4(10) = \sigma(10)$

child of R_4

$1+2+5+10=18$

$S_4(\cdot) =$ sum of divisors of n unless they're multiples of 4

• How many ways can 120 be written as the sum of 4 squares?

Divisors of 120 are 1, 2, 3, ~~4~~, 5, 6, ~~8~~, 10, ~~12~~, 15, ~~20~~, ~~24~~, 30, ~~40~~, ~~60~~, ~~120~~

$$S_4(120) = 1+2+3+5+6+10+15+30$$

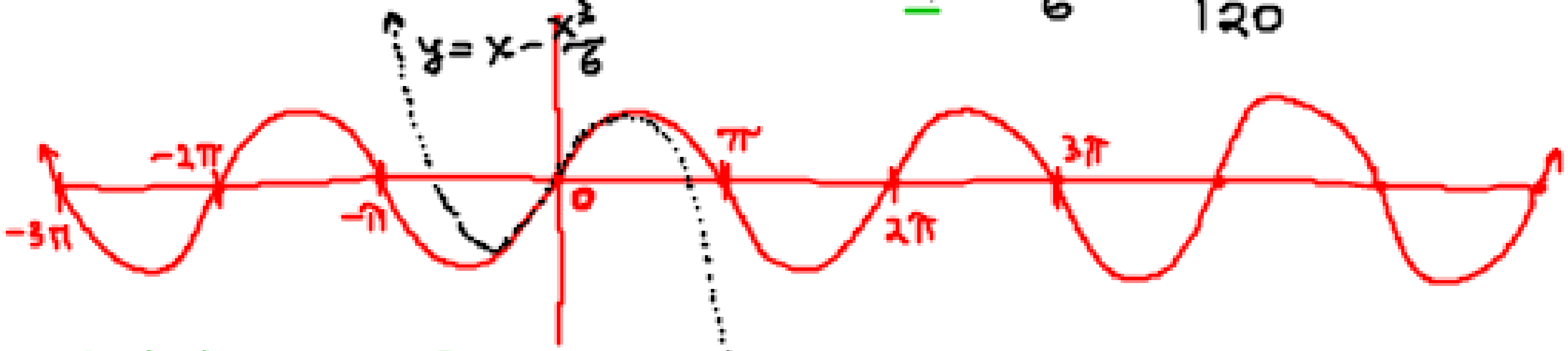
$$= 72$$

How does this relate to $S_4(30)$?

$s_4(120)$ = # of ways = $8S_4(120) = 576$

$f(x) = \sin x$

$$\sin x = x - \frac{x^3}{6} + \frac{x^5}{120} - \cdots$$



But let's use Factor Theorem instead.

$$\sin x = Ax(x-\pi)(x+\pi)(x-2\pi)(x+2\pi)(x-3\pi)(x+3\pi)\cdots$$

$$= Ax(x^2-\pi^2)(x^2-4\pi^2)(x^2-9\pi^2)\cdots$$

$$= x\left(1-\frac{x^2}{\pi^2}\right)\left(1-\frac{x^2}{4\pi^2}\right)\left(1-\frac{x^2}{9\pi^2}\right)\cdots$$

$$= x - \left(\frac{x^3}{\pi^2}+\frac{x^3}{4\pi^2}+\frac{x^3}{9\pi^2}+\frac{x^3}{16\pi^2}+\cdots\right)\cdots$$

$$x - \frac{x^3}{\pi^2}\left(1+\frac{1}{4}+\frac{1}{9}+\frac{1}{16}+\cdots\right) \doteq x - \frac{x^3}{6}\cdots$$