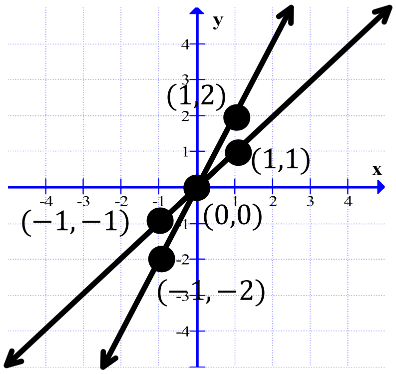
C12 - 10.0 -Functions Notes

Given : $f(x) = 2x$ $g(x) = x$



$f(x) = 2x$

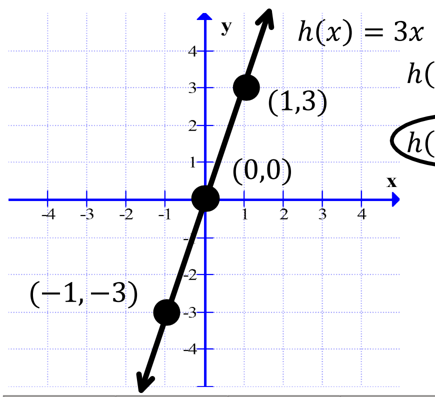
x	f(x)
-1	-2
0	0
1	2

$g(x) = x$

x	g(x)
-1	-1
0	0
1	1

Pick an x value
Add/Subtract/Multiply/Divide
y − values of f(x) and g(x)
Draw the new point.

Find $h(x) = f(x) + g(x)$.

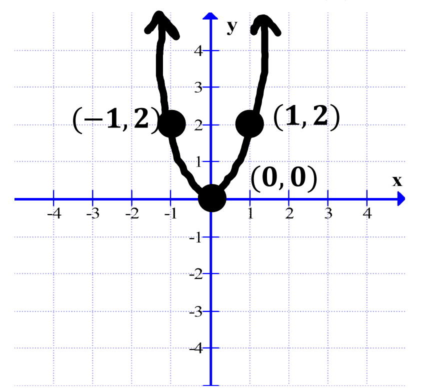


$h(x) = f(x) + g(x)$
$= (2x) + (x)$
$h(x) = 3x$

x	f(x)	g(x)	f(x)+g(x)
-1	-2	-1	-3
0	0	0	0
1	2	1	-3

Add y − values

Find $m(x) = f(x)g(x)$ $\mathbf{m(x) = 2x^2}$



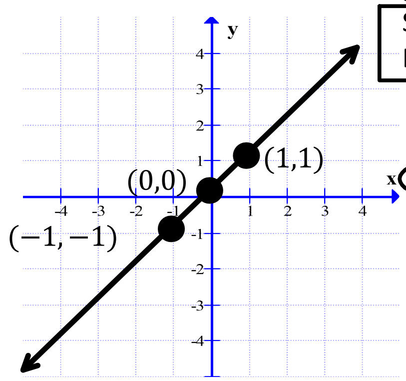
$m(x) = f(x)g(x)$
$= (2x)(x)$
$m(x) = 2x^2$

x	f(x)	g(x)	f(x)×g(x)
-1	-2	-1	2
0	0	0	0
1	2	1	2

Multiply y − values

Find $h(x) = f(x) - g(x)$. $h(x) = x$

Substitute with brackets.
Distribute a negative

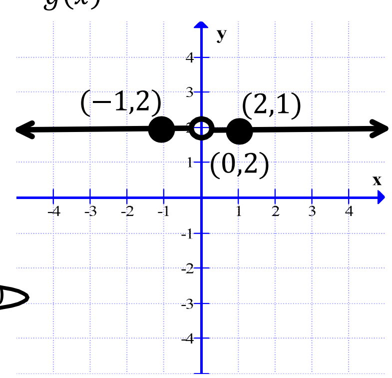


$h(x) = f(x) - g(x)$
$= (2x) - (x)$
$h(x) = x$

x	f(x)	g(x)	f(x)-g(x)
-1	-2	-1	-1
0	0	0	0
1	2	1	1

Subtract y − values

Find $m(x) = \dfrac{f(x)}{g(x)}$



$m(x) = \dfrac{f(x)}{g(x)}$

$m(x) = \dfrac{2x}{x}$

$m(x) = 2, x \neq 0$

x	f(x)	g(x)	f(x)÷g(x)
-1	-2	-1	1
0	0	0	und
1	2	1	Und
2	4	1	4

Divide y − values

C12 - 10.0 -Functions Notes

$f(x)=x+2$

Put whatever is inside the brackets in for x.
$f(THAT)=(THAT)+2$

$f(x)$ does not mean $f\times x$. $f(x)$ is one thing.
We dont divide by any part of $f(x)$ or $f(\#)$
Cant Distribute/Factor in/out of a function $f(x)$

$f(3)=?$ $(3,y)$

$f(x)=x+2$
$f(3)=3+2$
$f(3)=5$ $(3,5)$

$f(x+5)=?$

$f(x)=x+2$
$f(x+5)=(x+5)+2$
$f(x+5)=x+7$

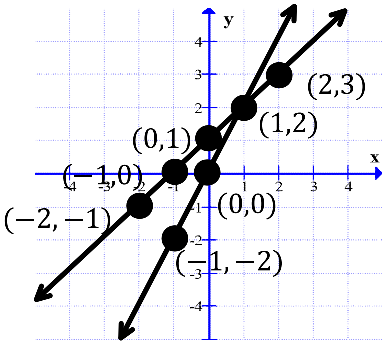
$f(3x)=?$

$f(x)=x+2$
$f(3x)=(3x)+2$
$f(3x)=3x+2$

$f(x)=6$ $(x,6)$ $y=f(x)$

$f(x)=x+2$
$6=x+2$
$-2 \quad -2$
$4=x$
$x=4$

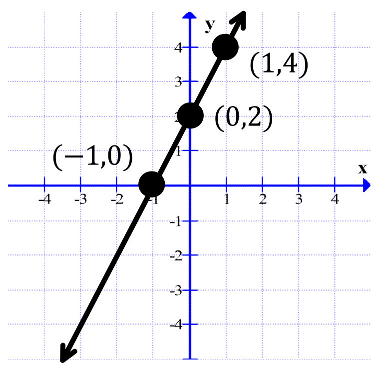
Given : $g(x)=2x$ $f(x)=x+1$



x	f(x)
-1	0
0	1
1	2

x	g(x)
-1	-2
0	0
1	2

Find $g(f(x))$: $g(f(x))=2x+2$



$g(x)=2x$
$g(f(x))=2f(x)$
$g(x+1)=2(x+1)$
$g(f(x))=2x+2$

Put $f(x)$ into g's x.
$g(f(x))=2(x+1)$

x	f(x)
-1	0
0	1
1	2

f(x)	g(f(x))
0	0
1	2
2	4

x	g(f(x))
-1	0
0	2
1	4

$g(-1)=0$
$g(0)=2$
$g(1)=4$

Find $g(f(1))$.

$f(x)=x+1$
$f(1)=(1)+1$
$f(1)=2$

$g(x)=2x$
$g(2)=2(2)$
$g(2)=4$
$g(f(1))=4$ $(1,4)$

OR

Find $g(f(x))$
Put 2 in for x

$g(f(x))=2(x+1)$
$g(f(1))=2(1+1)$
$g(f(1))=4$

Find $f(x)$ and $g(x)$ if:

$f(g(x))=(x-1)^2$

outside(inside)

Or $g(x)=x$ cheeky
$f(x)=(x-1)^2$

$f(x)=x^2$
$f(g(x))=(g(x))^2$
$f(x-1)=(x-1)^2$

$g(x)=(x-1)$
$g(x)=$ inside

$f(x)=x^2$
$f(x)=$ outside

$h(f(g(x)))=\dfrac{2}{(x+4)^2}-3$

$g(x)=x+4$

$f(x)=\dfrac{2}{x^2}$
$h(x)=x-3$

OR

$f(x)=x^2$
$h(x)=\dfrac{2}{x}-3$

$f(g(x))=x^2-6x+9$
$f(g(x))=(x-3)(x-3)$
$f(g(x))=(x-3)^2$
$g(x)=x-3$ $f(x)=x^2$

$f(g(x))=x^2-6x+13$
$f(g(x))=(x-3)^2+4$
$g(x)=x-3$ $f(x)=x^2+4$

C12 - 11.0 -Combinatorics Notes

FCP :

Example: A person has 3 shirts and 2 pairs of pants. How many different outfits can they wear?

$3 \times 2 = 6$

Example: How many 5 digit numbers are there?

$10\ digits\ to\ choose\ from: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9$

$$\underset{1\text{-}9}{\underline{9}} \times \underset{0\text{-}9}{\underline{10}} \times \underset{0\text{-}9}{\underline{10}} \times \underset{0\text{-}9}{\underline{10}} \times \underset{0\text{-}9}{\underline{10}} = 90{,}000$$

A number can't start with a 0. i.e. 02345 = 2345, which is not a 5 digit #.

Factorials!

$$\frac{7!}{4!} = \frac{7(6)(5)(4)(3)(2)(1)}{4(3)(2)(1)} = \frac{7(6)(5)}{1} = 7(6)(5) = 210$$

$$\frac{10! - 9!}{8!} = \frac{10!}{8!} - \frac{9!}{8!} = 81$$

Separate Fractions

$$\frac{n!}{(n-2)!} = \frac{n(n-1)(n-2)!}{(n-2)!} = n(n-1) = n^2 - n$$

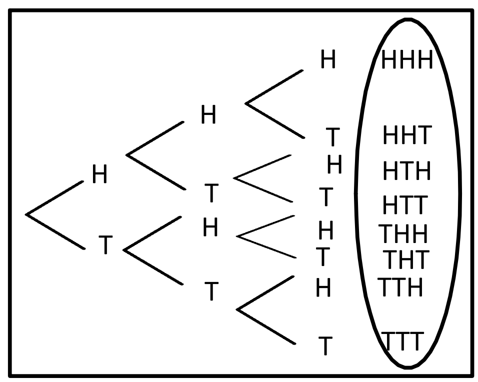
$n! + (n+1)!$
$n! + (n+1)n!$
$n!\,(1 + (n+1))$
$n!\,(n+2)$

GCF

If you flip a coin three times what is the total number of outcomes? Draw a tree diagram to confirm.

$$\underset{H,T}{\underline{2}} \times \underset{H,T}{\underline{2}} \times \underset{H,T}{\underline{2}} = 2^3 = 8$$

$(outcomes\ per\ trial)^{\#\ of\ trials}$
$2^3 = 8$



Arranging Two of the Letters of ABC

No restrictions (repeats allowed)

$$\underset{(A,\ B\ or\ C)}{\underline{3}} \times \underset{(A,\ B\ or\ C)}{\underline{3}} = 9$$

AA BB CC

AB BA AC CA CB BC

$Case\ 1: 2\ same$ + $Case\ 2:\ 2\ different$ $\quad {}_3C_1 + {}_3C_2 \times 2!$
$3 + 3 \times 2! = 3 + 6 = 9$

No repeats

Permutation *Particular Order matters*

AB BA AC CA CB BC

$${}_nP_r = \frac{n!}{(n-r)!}$$

$= 3 + 6$
$= 9$

$$\underset{(A\ or\ B\ or\ C)}{\underline{3}} \times \underset{(B\ or\ C)}{\underline{2}} = 6$$

$${}_3P_2 = \frac{3!}{(3-2)!} = \frac{3!}{1!} = \frac{3!}{1} = 3! = 3 \times 2 \times 1 = 6$$

Combination *Order doesn't matter*

AB=BA AC=CA BC=CB

$${}_nC_r = \frac{n!}{r!\,(n-r)!}$$

$${}_3C_2 = \frac{3!}{2!\,(3-2)!} = \frac{3!}{2! \times 1!} = \frac{3!}{2!} = \frac{3 \times 2 \times 1}{2 \times 1} = \frac{6}{2} = 3$$

C12 - 11.0 - Combinatorics Review

Logic

Guess and Check

Fundamental Counting Principle $a \times b \times c$ Factorial Notation!

Blanks ___ , ___ , ___ $\frac{\#\ options}{options}$

Repeats?

Replacement

Given!

$\times \div 2\ or\ \#!$

Tree Diagrams

Table

Venn Diagram

Multiply Branches

Add Leaves

$(outcomes\ per\ trial)^{number\ of\ trials}$

$All - None$ $Cannot = All - Can$

Cases! Cases: Multiply within cases, add separate cases.

Identical Objects $\frac{(\#\ of\ letters)!}{(repeating\ letter)!\,(other\ repeating\ letter)!\ldots}$ $Circle: (n-1)!$

Combinatorics Formulas

Permutations: Order Matters

Combinations: Doesn't Matter

$n \geq r$

$_nP_r = \frac{n!}{(n-r)!}$

$\binom{n}{r}$ $_nC_r = \frac{n!}{r!\,(n-r)!}$

$_nC_r = \frac{_nP_r}{r!}$

n :# of objects to choose from

r : # of objects choosing

$Paths\ in\ Squares: \frac{(l+w)!}{l!\,w!}$ $Paths\ in\ Cubes: \frac{(l+w+h)!}{l!\,w!\,h!}$

Binomial Theorem $t_{k+1} = {}_nC_k a^{n-k} b^k$ $;(a+b)^n$ $;n+1\ terms$

; k is always one less than the term number.

Probability $\frac{\#\ of}{Options}$