Unit 3

In this Unit we will:

- graph linear functions
- find the domain and range for a situation
- look at function notation
- slope and rate of change of graphs
- linear equations in various forms

Dec 14-8:55 AM

Chapter 6

In this chapter we will:

- create graphs that represent situations
- interpret graphs
- apply characteristics of linear relations to graphing
- determine acceptable range of values
- work with function notation
- work with slopes and rate of change.

Dec 14-8:58 AM

CHAPTER 6

Linear Relations and Functions

Apr 19-3:13 PM

6.1 Graphs of Relations

A graph is a method of effectively and visually representing the relationship between two quantities.

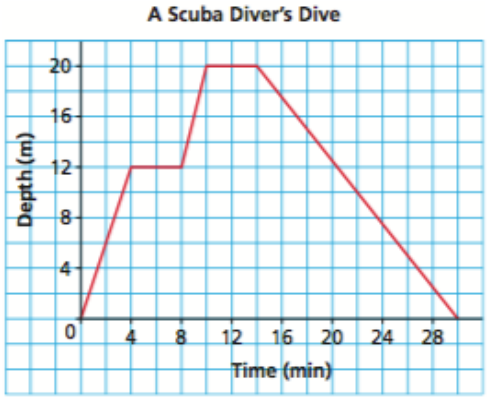
Common comparisons are **distance vs. time** and **speed vs. time.**

Reading a graph can tell us a lot of information about the situation quickly.

But like reading words, reading graphs is a skill that is increasingly and continually important in our society.

Apr 19-3:32 PM

Take this graph for example, what is happening?



How many minutes did the dive last?

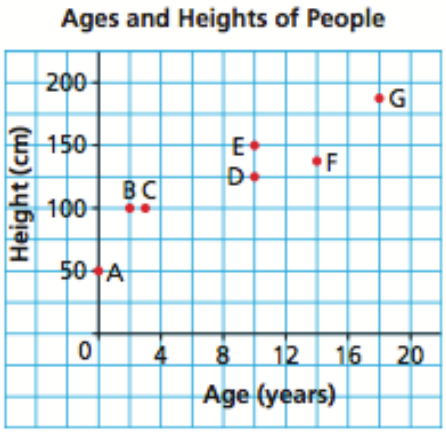
At what times did the diver stop the decent?

What was the greatest depth the diver reached?

For how long did the diver stay at that depth?

Apr 19-3:32 PM

Answer the following questions about the graph below:



a) Which person is the oldest? What is her or his age?

b) Which person is the youngest? What is her or his age?

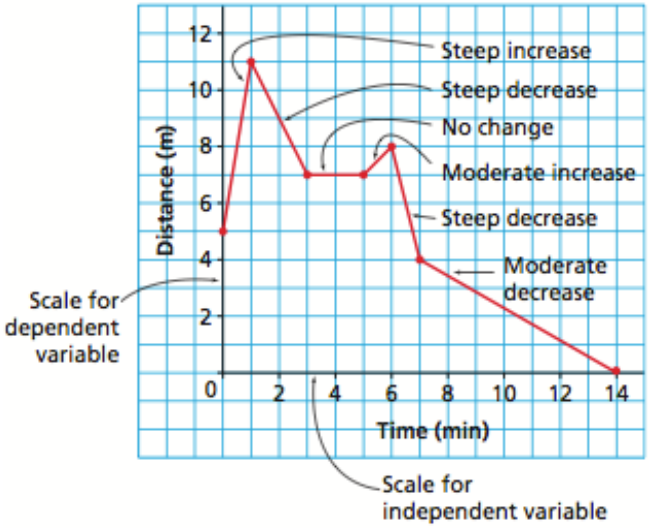
c) Which two people have the same height? What is this height?

d) Which two people have the same age? What is this age?

e) Which of person B or C is taller for her or his age?

Apr 22-11:13 AM

The properties of a graph can provide information about a given situation.



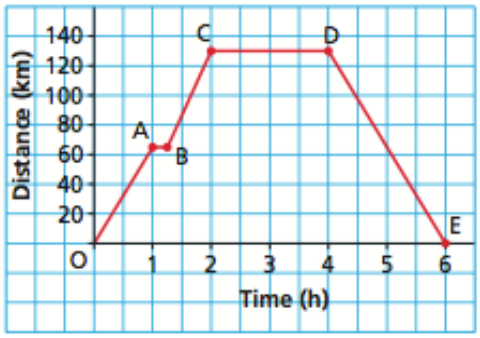
A constant rate of change is represented by a straight line. The steeper the line, the faster the rate of change.

Apr 22-11:08 AM

Interpret the graph - tell it's story!

Describe the journey for each segment of the graph.

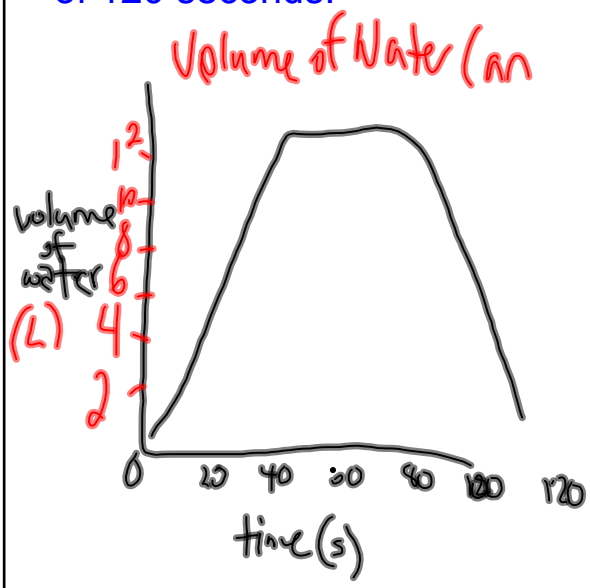
Day Trip from Winnipeg to Winkler, Manitoba



The distance between Winnipeg and Winkler is 130 km.

Apr 22-10:45 AM

Draw the graph showing how the volume of water in a watering can changes over time as it is filled and used over a total span of 120 seconds.



Apr 22-11:09 AM

Hmwk: Pg 274 #1-4, 6, 7, 10, 15

Oct 24-12:24 PM

Let's talk about it...

1. For a graph of distance as a function of time, what does each segment represent?
   - a horizontal line segment
   - a segment that goes up to the right
   - a segment that goes down to the right
2. For a graph of speed as a function of time, what does each segment represent?
   - a horizontal line segment
   - a segment that goes up to the right
   - a segment that goes down to the right

Apr 22-11:12 AM

Terminology

A **SET** is a collection of distinct objects

A set could be made up of anything. We generally think of numbers in math - but it could be articles of clothing, food, colors, people, etc.

An **ELEMENT** is an object in the set.

If the set is the list of numbers from 1 to 5, the number 3 is an element in the set. If the set is all colors, then red is an element of the set.

Note: The order of the elements in the set does not matter.

A **RELATION** associates the elements of one set with elements of another set.

for example:

A banana has the color yellow.

element of first set | relation | element of second set

Apr 19-3:32 PM

We can represent all relations using **ordered pairs**:

{(apple, red), (apple, green), (banana, yellow), (cherry, red)}

{(1,2), (2,3)}

Or using **a table**:

Fruit	Color
apple	red
apple	green
banana	yellow
cherry	red

Or in **words**

Or depending on the relation, as a **graph, or equation.**

Apr 12-5:26 PM

Note: The **order** of the words in the ordered pair and columns in the table **matter!**

It makes sense to say "a banana has the color yellow" but it does not make sense to say "yellow has the color banana"

A relation has direction **from one set to the other set.**

Apr 12-5:53 PM

Linear vs. Non Linear

Recall: Constant change is represented graphically by a straight line.

Therefore, graphs representing a relation with a constant change are linear. (**line**ar meaning straight)

Graphs that **do not** represent a constant change are **non-**linear.

Linear equations will have one or two variables and its degree will be 1. Non-Linear equations will have a degree greater than 1.

Are the following equations linear or non-linear?

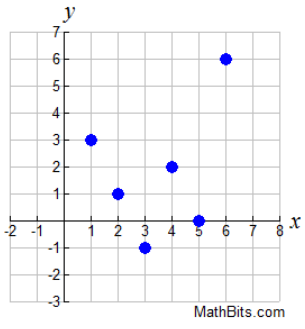
$x = 7$ ✓

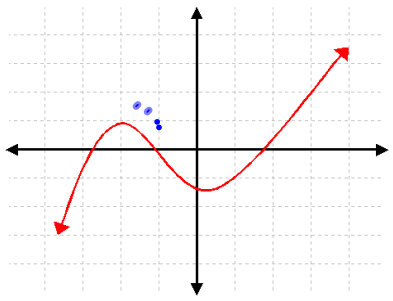
$3m + 2n = -12$ ✓

$2x + y^2 = 6$ ✗ NOT LINEAR

Oct 24-12:42 PM

Discrete or Continuous Data





Discrete: cannot draw a line through data points.

Continuous:

Dec 5-12:40 PM

Independent and Dependent Variables

In a relationship with two variables one is the independent variable and one is the dependent variable.

Which variable is the independent and dependent variable?

How do you know?

Hours Worked	Gross Pay
1	10
2	20
3	30
4	40
5	50
6	60

{(1,10),(2,20),(3,30)...}

{(,)}

Dec 5-12:43 PM

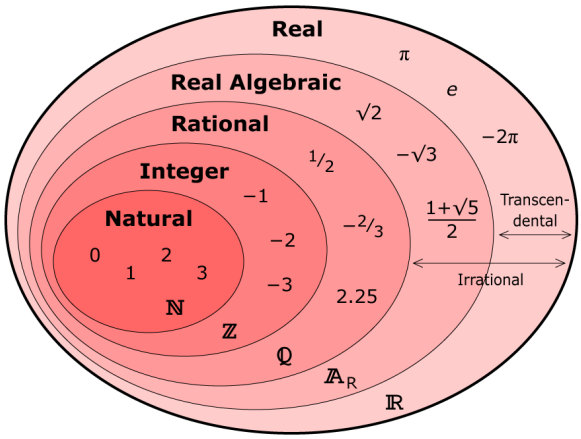
Homework: Pg 287 #1-4

Hmwk from the other day: Pg 274 #1-4, 6, 7, 10, 15

Dec 5-12:51 PM

6.3 Domain and Range:
- Textbook pg. 292-294 Activity: Domain & Range
- Read pages 294-295: How to express Domain and Range
  -Take notes on meaning of number lines, set notation, and interval notation.
- Work through Examples 1, 2, and 3 on pages 295-299

Homework: Pg 301 #1, 2, 4, 5, 7, 8

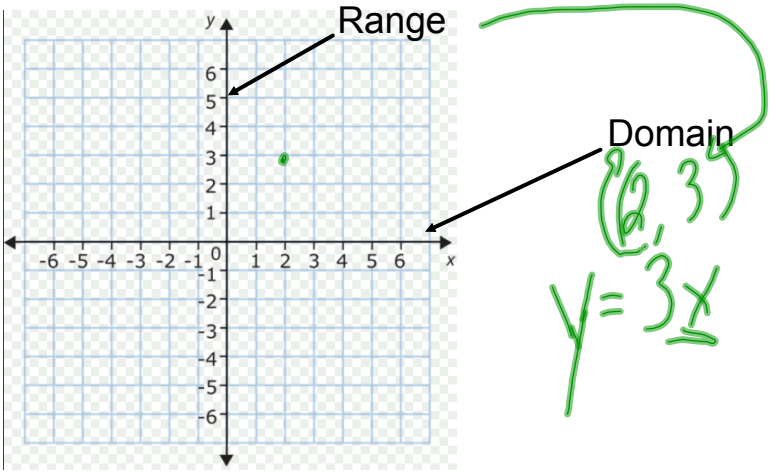


Dec 5-12:57 PM

6.3 Domain and Range

When comparing two quantities, the words domain and range are used to describe the values that are appropriate.

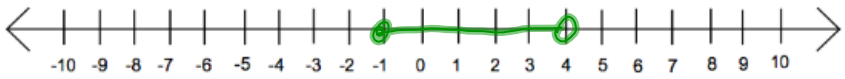
The values for the domain are from the independent variable and the values for the range are the dependent variable.



Dec 5-12:59 PM

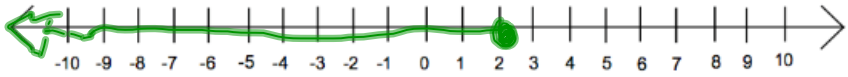
Number Lines gives a picture of the values that are allowed.

$-1 \leq x < 4$



$-6 \leq x \leq -3$ $\quad$ $4 < x < \infty$

$-\infty < y \leq 2$



Dec 5-12:59 PM

List useful way when dealing with discrete data where there isn't very any numbers in the set.

(2,0) (3,1) (4,2)

(x, y)

Domain: (2, 3, 4)

Range: (0, 1, 2)

Dec 29-10:16 AM

Set Notation is a formal mathematical way to give the values of the domain and range. (The main way you will do it from now on in your mathematical career.)

$\{x \mid x \geq 10, x \in \mathbb{R}\}$

$\{y \mid y < 5, y \in I\}$

Dec 29-10:17 AM

Interval Notation uses brackets to represent an interval. (You will use this method less frequently from now on through your mathematical career.)

( ) does NOT include.

[ ] does include

$-3 \leq y < \infty$

$[-3, \infty)$

y: $[-2, 10]$

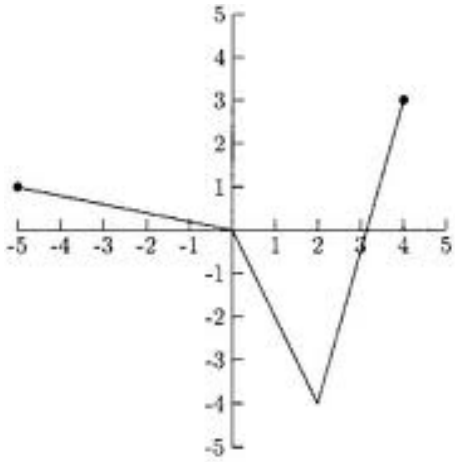
$-2 \leq y \leq 10$

x: $(5, 7]$

$5 < x \leq 7$

Dec 29-10:20 AM

What is the Domain and Range of this Graph?



Recall the ordered pair representation of relations....

Which axis represents the Domain? The Range?

In a set of ordered pairs, the *x*-coordinate is called the input number, and the *y*-coordinate is called the output number.

Therefore, the x-coordinates "make up" the domain and the y-coordinates "make up" the range.

Apr 19-3:32 PM

Example:

A variety of corn plant grows at an average rate of 4.5 cm per day from the start of the third week of growth to the end of the sixth week. The plant's growth can be modelled using the formula $h=4.5a + 25$, where h represents the height of the plant in centimetres, and a is the age of the plant, in days.

Create a graph of a cornstalk's height from the beginning of week 3 to the end of week 6.

Domain: $14 \le a \le 42$

$h = 4.5a + 25$

Range: $4.5(14)+25 = 88$

$4.5(42)+25 = 214$

Domain: $[14, 42]$

Range: $[88, 214]$

Dec 29-10:22 AM

Using a graphing calculator pg 302 #4

Other problems pg 303 #5-10

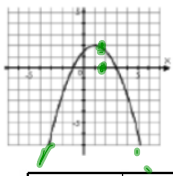
Dec 29-10:35 AM

There are functions and there are relations. All functions are relations, but not all relations are functions...

What is a function? How is it a "special" relation?

Function

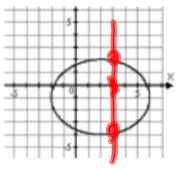
{(2, –1), (5, 1), (–5, 1)}



X	Y
1	2
2	4
3	6
4	8
5	10
6	12

Non-function

{(6, 3), (6, –5)}



X	Y
1	2
2	4
1	5
3	8
4	4
5	10

Dec 29-10:48 AM

Properties of functions

A Relation vs. A Function

A **relation** produces **ONE OR MORE** outputs for one input.

A **function** produces **ONLY ONE** output for one input.

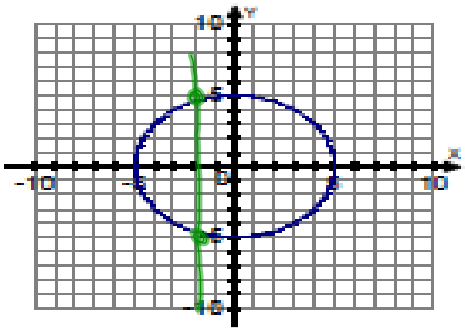
Note: All functions are relations but not all relations are functions.

Apr 18-2:05 PM

To determine if a graph is a relation or a function we use a **"Vertical Line Test".**

To do this we move a vertical line through the graph and if it intersects the graph ONLY once then it is a function, if it intersects **any** point(s) more than once then the graph is a relation.

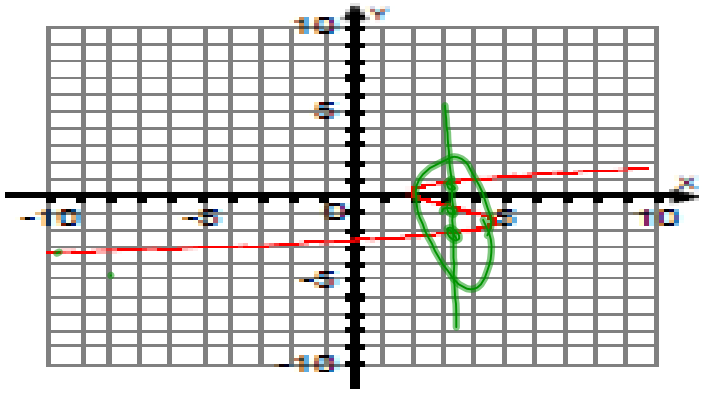
Is the following graph a function or a relation?



Apr 19-3:32 PM

Function OR Relation?

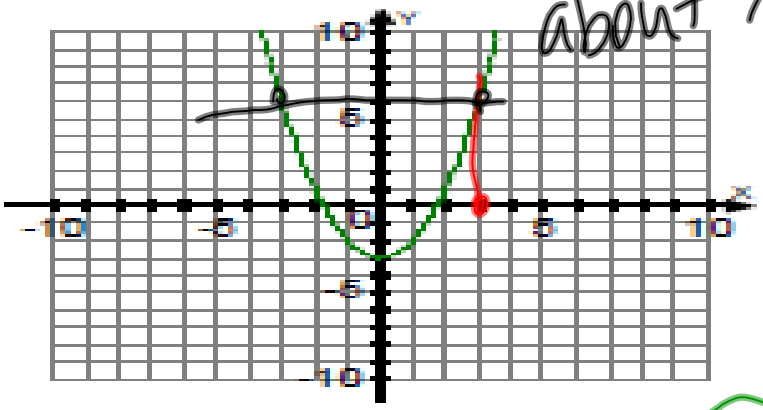
Non-function

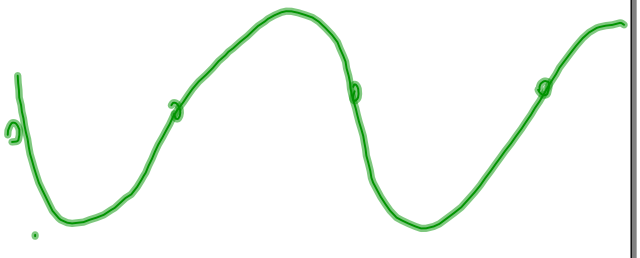


Apr 19-4:14 PM

Function OR Relation?

we only worry about x.





Apr 19-4:14 PM

HMWK: Function vs. Non Function Worksheet

Apr 19-4:13 PM

6.4 FUN with Functions

Dec 29-11:29 AM

Functions can be written in "FUNCTION NOTATION". The function *y=4x+1* is written as *f(x)=4x+1*. The name of the function is *f,* with a variable name of *x*. In this example, 4x+1 is the rule that assigns a unique value for y for each value of x.

Note: Any letter may be used to name a function. An example of this is $v(t)=9.8t^2$.

Function notation highlights the input/output aspect of a function.

$f(x) = 4x + 1$

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

$f(2) = 9$

f(x) is read "f of x" or "f at x"

(2, 9)

Dec 29-10:59 AM

To write the equation ***d = 4t + 5*** in **function notation**, we may write ***d(t) = 4t + 5***. ***t*** represents an element of the domain and *d(t)* represents an element of the range. **Notice the *d(t)* replaces the *d*.**

d(t) is read "d of t", and means that the function, named d contains t as its variable. This notation is used to simplify recording and substituting values

When we write an equation that is not related to a context, we use *x* as the independent variable and *y* as the dependent variable. Then an equation in two variables such as ***y = 3x – 2*** may be written as ***f(x) = 3x – 2.***

Apr 19-3:32 PM

Ex. The equation $C = 25n + 1000$ represents the cost, C dollars, for a feast following an Arctic sports competition, when n is the number of people attending.

a. Describe the function. Write the equation in function notation.

$C(n) = 25n + 1000$

b. Determine the value of $C(100)$. What does this number represent?

$C(n) = 25n + 1000$

$C(100) = 25(100) + 1000 = 3500$ -> cost.

c. Determine the value of n when $C(n) = 5000$. What does this number represent?

$C(n) = 25n + 1000$ $C(n) = 5000$

Apr 19-3:32 PM

Skye has a cellphone plan for a monthly fee of $20 plus 15 cents for each text message to or from a number not on a list of favourites. Skye's monthly bill can be modelled by the relation $C=0.15n+20$, where C is the total charge, in dollars, and n is the number of additional text messages.

a. Write the relation in function notation.

b. Make a table of values. Graph the function manually and on your calculator.

c. If Skye's cell phone bill is $22.25, how many additional text messages are there?

Apr 19-3:32 PM

Homework: Pg 311 #2-6, 8, 9

Apr 22-11:13 AM

Function challenge problems.

1. Sharon created a function in the form f(x) = __x + __. To figure out the actual equation, students give Sharon input values and she gives them the output from the function. The values are f(1) = 5, f(2) = 8, f(-1) = -1, and f(-2) = -4. What is the equation of Sharon's function?

2. Explain the difference between f(2) and f(x) = 2.

3. The input for a function can be another function! If *h(x)=2x-5*, determine a simplified expression for *h(2x+3).*

4. Jean-Marie has never seen function notation. When he sees a question that asks him to determine the value of *f(x+2),* he gives his answer as *fx + 2f.*

a. How does Jean-Marie interpret the question?

b. Explain the meaning of this question to Jean-Marie in the context of functions.

Oct 24-12:08 PM

Homework: Watch Slope MIX Video and answer follow-up questions at the end
https://mix.office.com/watch/167xkt3kj1uy7
It will be assumed that you watched the video and understand it. I will not be doing a full instruction on these concepts.
(Also, I can track if you watched it... So watch the video!)

Dec 31-10:12 AM

6.5 Slope

Look at your textbook page 319 and do the "YOUR TURN" activity.

Jan 1-3:46 PM

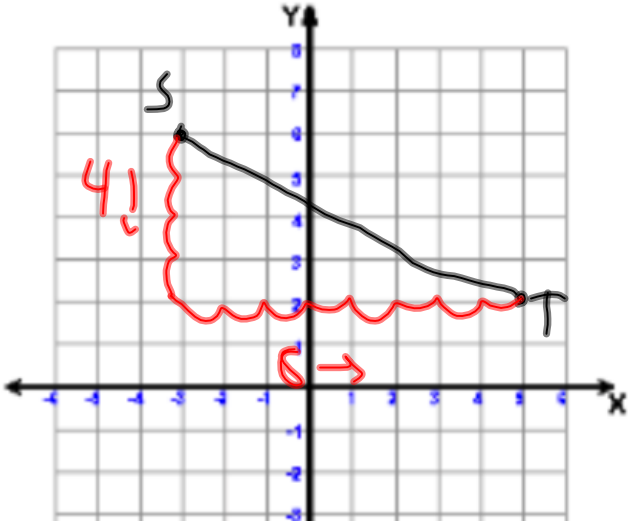
Determine the slope of the line segment with the given end points of S(-3,6) and T(5,2).

Method 1: Graph it

$m = \frac{\text{rise}}{\text{run}}$

$m = \frac{-4}{8}$

$m = -\frac{1}{2}$



Jan 1-3:48 PM

Determine the slope of the line segment with the given end points of P(-5, 6) and Q(1,10).

Method 2: Use the formula.

$m = \frac{\Delta y}{\Delta x}$

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10-6}{1-(-5)} = \frac{4}{6} = \frac{2}{3}$

Jan 1-3:50 PM

(home)work: Pg 325 #1-11, 18

Jan 1-3:52 PM

Slope RG

Jan 1-3:58 PM

Review

Jan 1-3:58 PM

Attachments

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