**Lema 1**

(a)

**demonstrate:**

Notate

According to vector defenition

And according to the defenition of dirval 𝑙\_g

according to defenition of distanse.

By defenition of absolute value

hence

(b)

**demonstrate:**

Notate

By the defenition of vectors

According to the defenition of directional values

Hence

According to lema (a)

So in the positive case

And finnaly

(c)

**demonstrate:**

Notate

Therfore and according to defenition of vectors

According to defenition of directional values

Also

(d)

**demonstrate:**

notate

hence

according to (c)

(e)

Vector.def.i Vector.def.ii

**Data:**   
**demonstrate:**

If

Than according to data

The value given to vectors

Hence if

Then

**Q.E.D**

Vector.def.i Vector.def.ii

**Data:   
demonstrate:**

If

Than

its obvious that

And already stated that

hence according to data

**Q.E.D**

**Proof 1**

**Demonstrate:**by the defenition of vectors

**QED**

**Corollary from Proposition 1**:

**(a)**

**Data:**   
**demonstrate:**

According to transitivity of directions

Notate

According to Lema 1

According to the proposition

and hence

(b)

**Data:**   
**demonstrate:**

According to anticomotativity of directions

According to weak bacward transitivity of directions

Notate

According to Lema 1

According to the proposition

and hence

**Lemma 2**

**Demonstrate:**

**Proof 2**

**Demonstrate:**

For conveince we'll notate

For two sets to be equal, any point that belong to the one should also belong to the other.

Furthermore, if a point belongs to a path it belongs to its set.

So we will be done if the following be proved:

Assome

To describe in the terms of a path we'll notate

It is true that

If we assume then by transitivity

Meaning

Which is false since belong to which means

Either way we conclude that   
If then and we done.  
If we need to be sure that is constructed before , or that it is   
Since

We know that

If we done, otherwise:  
recall

Hence

and are two sums of and since the latter vectors are infinatly small, any summation can't just skip . is a smaller sum.  
so where *.* so get cunstructed before .   
We proved

The proof in the other way is similar and reversed.

**Proof 3**

Acording to the defenition of a a stright path any two adgecent points belonging to the path have the same direction as the path itself. So acording to proposition 1 the distance between them can be added (because ) and so forth. The length is the sum of all distances so by this method applied infinite times it should be demonstrated to be equal the distances between the first points and the last point or Q.E.D

**Proof 4**

Since we know that the distances don't change when your change the order of the consequtive point. That it Q.E.D

**Proof 5**

There exist  
according to prop 3 there exist   
according to postulate 1 there exist only a single such that  
and

So for in a certain place dir and distance identify a specific line

Of course if then   
if then it is so. if we consider that is different from so necessarily (if their place value is same in direction I and is different in a other direction j then and the transitivity of directions with is ruined)  
while so and according to proposition 3 the same is true for their length.

**Proof 6:** let's assume there exist such a point

And let's take

According to the def. of lines

But according to the def. of parallel lines

Because

And that's a contradiction.

**Proof 7A:**   
let   
be  
and lets notate

It's easy to demonstrate that

The proposition claim that

Therefore if (where ) which is possible then therfore is possible.

If you look again at this demonstration and suppose that there was some number of point different than that belonged to both lines, you'll notice it doesn't make a diffrence to the proof. Therefore if the number is zero or greater than zero there possibly could be one more such point. QED

**Proof 7B:**

it's easy to demonstrate that

The proposition claim that for

and that  
according to the reverse line definition that means that

Q.E.D

**Proof 8**

Part 1:

Let us construct

And let's assume there is a point

There is no contradiction with assuming and therfore this is possible that

Part 2:

Let assume

If is different than then there is a direction defined by the 2 points.

If so

And v.v if so

So doesn't belong to both lines.

QED

**Proof 9**

**Data:   
Demonstrate:**

According to transitivity

We could write

According to postulate 2 and its derivatives

Assingning this values  
Q.E.D

**Proof 9:**

We will notate

By arithmetic

and

Therefore

In terms of the proposition

And

Now we want to close on π.

We know that at least one of the reminders is smaller or equal to π w/o loss of generality we are going to say it is . First we deal with the case of smaller than

If

According to proposition 10

And according to proposition 11

From also

And from prop 10

Hence

For the sum to be 3π (the only possibility reminding beside π, note that any reminder is bigger than 0 and so is the sum) all 3 should be equal π let's check what happen if one of them equal π

If then

and because it's establish that anf are on the same line with

specifically the order is revelled to us so

so and

so

Q.E.D