

# A Problem For Paul

October 31, 2012

## The Problem

Given a 2-blade  $B$  and a vector  $v$ , find the vector  $v'$  which is the orthogonal reflection of  $v$  about  $B$ .

## One Possible Solution

Start by drawing a picture!

Now, without loss of generality, we can write  $B$  as

$$B = a \wedge b,$$

where  $a$  and  $b$  are a pair of orthogonal vectors, where  $b$  is unit-length, and where  $v$  is orthogonal to the vector  $a$ .

It follows that  $|a| = |B|$ . Why?

We will now prove that

$$v' = -BvB^{-1}.$$

To begin, notice that  $B = ab$ . Why?

Next, notice that  $B^{-1} = ba/|a|^2$ . Why?

We then notice that  $bvb = v'$ . Why?

Now notice that  $-av'a/|a|^2 = v'$ . Why?

We now see that

$$-BvB^{-1} = -\frac{abvba}{|a|^2} = -\frac{av'a}{|a|^2} = v'.$$

And there we have it!