

18.02SC Multivariable Calculus, Fall 2010  
Transcript – Recitation 4, Area of a Parallelogram

DAVID JORDAN: Hello, and welcome back to recitation. I'd like to work this problem with you in which we're going to use determinants to compute the area of a parallelogram sitting in a plane. So why don't you take a moment to, why don't you take some time to work this out, and we'll check back and you can see how I did it.

OK, so let's get started on this problem. Now the first thing that we need to be careful about with this problem is, we know that we want to take a determinant, but we need to be careful. Determinants of pairs of vectors make sense. Determinants of points do not make sense. So here we have these four points, which are the endpoints of the parallelogram. And what we need to do from these four points is get some vectors that we can compute with.

So over here, I have taken the vectors which connect the endpoints of the parallelogram. So you'll see that this  $\begin{pmatrix} 6 \\ 1 \end{pmatrix}$  here, this vector  $\begin{pmatrix} 6 \\ 1 \end{pmatrix}$  is coming from the point  $(1, 1)$  in the original parallelogram and  $(7, 2)$ . So this vector  $\begin{pmatrix} 6 \\ 1 \end{pmatrix}$  is just the difference of  $(7, 2)$  and the point  $(1, 1)$ . And similarly  $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$  here is the difference of our original point  $(6, 3)$  and our base point  $(1, 1)$ .

So now that we have these two vectors, the area of our parallelogram is just going to be the determinant of our two vectors. Well, we'd better be careful. It's going to be plus or minus the determinant is going to be the area.

So let's compute this determinant. So we find  $6 \times 2$  minus  $5$ -- so we get  $12$  minus  $5$ -- is  $7$ . Now we got a positive number, and so this plus or minus we take to be positive. Had we computed our determinant by transposing the rows here, then we might have found a negative seven, and of course we want our area to be positive, so we would just choose seven.

So, let me just go through the one tricky part of this problem is the original endpoints of our parallelogram are not what are important for the area. What's important is the vectors which connect the two of our endpoints together. And so we computed those  $\begin{pmatrix} 6 \\ 1 \end{pmatrix}$  and  $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ , and then taking their determinant gives us the area of the parallelogram. OK, I'll leave it at that.

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