Speed - Distance - Time

A vital part of sailing farther from Courageous is being able to get back before sunset, and in order to do that you must be able to accurately (or at least conservatively) estimate how long it will take to get back. This will depend on three major factors: Your distance from Courageous, Wind (speed and direction), and Current (speed and direction). A Rhodes 19 has a top speed of about 6 knots; a j/22 about 7. It therefore stands to reason that 1 hour before sunset, under no circumstances should you be more than 6 or 7 miles from Courageous. If the tide is ebbing, you must account for that also: a 1-knot tide turns that 6 or 7 miles into 5 or 6. Will you have to beat upwind for any part of your trip back? Beating takes about twice as long as sailing in a straight line on a reach. Beating into an opposing current will be exceptionally slow. To top it all off, you may not have enough wind to go at your maximum speed! Where you go and when you decide to head back will be dictated by wind and tide.

Let's start with the basics, and forgive me if you didn't want to revisit middle school pre-algebra: Speed, Distance, and Time. Since one knot of boatspeed equals one nautical mile per hour, it takes a boat moving at one knot one hour to go one mile. But how do we do more complicated calculations? With the following three formulae (which are really all the same one, rearranged): Speed equals Distance divided by Time. Time=Distance/Speed. D=S•T. Let's try a few exciting problems:

1.) How far can a boat making 4 knots go in 2 hours?

I need to solve for Distance, because the question is asking "how far". Therefore I use the last formula, D=S•T. I know the other two variables, S=4 knots and T=2 hours. D=4•2, D=8 Nautical Miles. Simple, right?

2.) How fast am I going if I go 3 nautical miles in half an hour?

This time, I need to solve for Speed, since the question asks "how fast". I use the first formula, S=D/T. I know D=3 nm and T=.5 hr, so S=3/.5; S=6 knots.

Now let's look at some complicating factors: Beating and Current. As I mentioned above, a boat beating into the wind will take longer to reach its destination than one reaching. If your destination lies directly upwind, only ~.7 (cos45) of your boatspeed is going towards that destination. The rest is lost in your movement from side to side. Therefore you must multiply your boatspeed by .7 if you are beating to a destination directly upwind.

Current is simple - if you are going against the current, you subtract it from your boatspeed. If you are going with the current, you add it. If you are going across it at an angle, you'll need to do some trigonometry, but thankfully that doesn't happen too often around here.

Let's try a couple more example problems:

3.) You are beating towards Courageous (which lies directly upwind). You are 2 nautical miles away and going at 3 knots. How long will it take you to get back?

Since the question wants us to solve for time, we use the form T=D/S. We have the distance already (2 nautical miles), but we need to find our speed towards Courageous, or Velocity Made Good (VMG). To find VMG, simply multiply the speed by the cosine of the average angle at which your destination bears relative to your course (in this case 45º, a good average close-hauled angle, gives a cosine of ~.7; use .7 when in doubt). 3•.7=2.1, so your final equation should be T=2 nm/2.1 kts, T=.95 hours.

4.) You are beating towards Courageous (which lies directly upwind). You are 3 nautical miles away and going at 4 knots against a .6-knot tide. How long will it take you to get back?

This question is similar to the last one, but with current added. We use the same form T=D/S since we are still solving for time, and we still need to figure out VMG. 4 knots • .7 gives us 2.8 knots; from this we subtract the current of .6 knots for a VMG of 2.2 knots. T=3 nm/2.2 kts, so T=1.36 hours.

A trip back to Courageous from Lovell Island might take one hour with a strong following wind and a flooding tide, but with an ebbing tide and light wind it could take five. This is why these calculations are important.