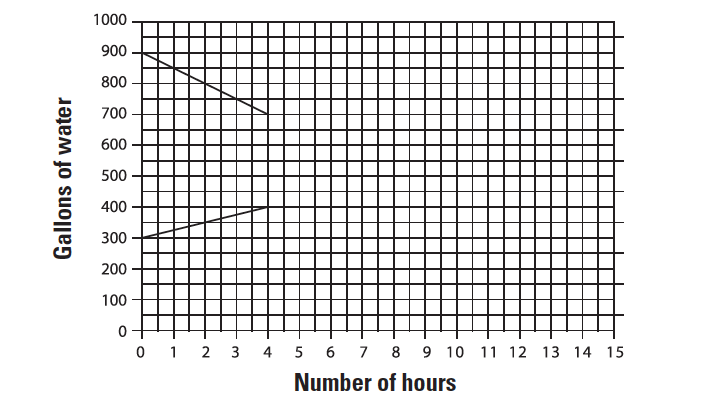
**The Two Storage Tanks Task[[1]](#footnote-1): Sample Solutions**

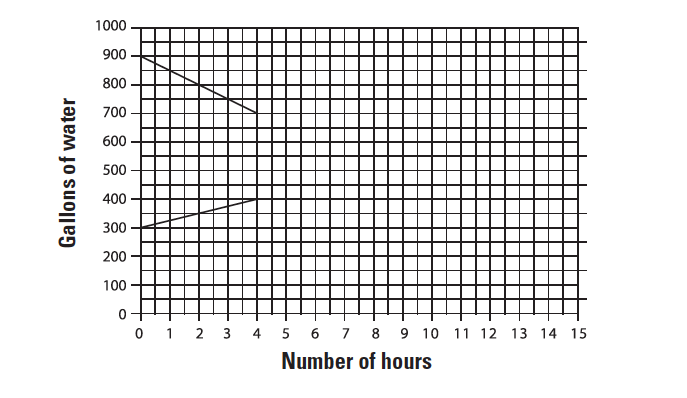
Two large storage tanks, T and W, contain water. T starts losing water at the same time additional water starts flowing into W. The graph below shows the amount of water in each tank over a period of time. Assume that the rates of water loss and water gain continue as shown.



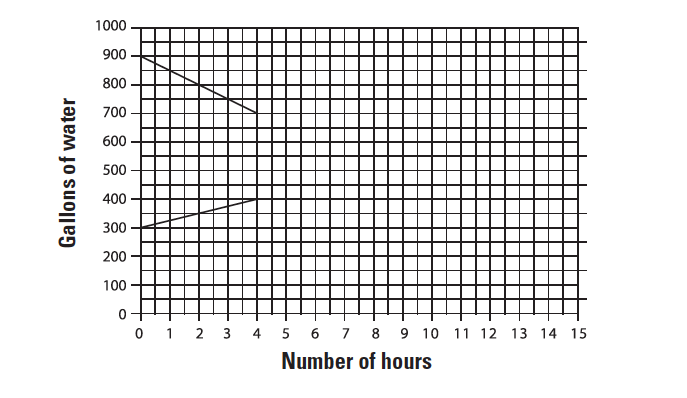
1. When will the two tanks contain the same amount of water? Explain how you found your answer and interpret your solution in terms of the problem.

Each tank will contain 500 gallons of water at 8 hours. There are several ways that students can determine this, as described below.

**Graphical solution I.** Using a straight edge, students can extend the line segments and see that they will intersect at the point (8, 500):



**Graphical solution II.** Students could also extend the line segments by using the slopes of the graphs (Tank T decreases 100 gallons every 2 hours; Tank W increases 50 gallons every 2 hours), as shown below:



**Numeric solution.** Students might translate data from the graph to a numeric table and then extend the table (using the constant rate of change) until the amount of water in each tank is the same:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Number of hours | Number of gallons in Tank T | Number of gallons in Tank W |
| Points shown on graph | 0 | 900 | 300 |
| 1 | 850 | 325 |
| 2 | 800 | 350 |
| 3 | 750 | 375 |
| 4 | 700 | 400 |
|  | 5 | 650 | 425 |
|  | 6 | 600 | 450 |
|  | 7 | 550 | 475 |
|  | **8** | **500** | **500** |
|  | 9 | 450 | 525 |
|  | 10 | 400 | 550 |

**Symbolic solution.** If students have written equations that model the number of gallons in each storage tank at any number of hours, they could set them equal to each other in order to determine the time at which the tanks will hold the same amount of water:

Tank T: *y* = 900 – 50*x* Tank W: *y* = 300 + 25*x*



Students could also verify their answer by letting x = 8 and checking that the outputs for the equations are the same:

If x = 8, the amount of water in Tank T is 900 – 50(8) = 900 – 400 = 500 gallons

If x = 8, the amount of water in Tank W is 300 + 25(8) = 300 + 200 = 500 gallons

**Alternate solution.** Another way to think about the time at which the tanks will contain the same amount of water is as the time at which the *difference* between the amount of water in the two tanks is zero (i.e., *y*T – *y*W = 0). This can be found numerically or symbolically, as shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| Number of hours  *x* | Number of gallons in Tank T  *y*T | Number of gallons in Tank W  *y*W | Difference between the number of gallons in Tanks T and W  *y*T – *y*W |
| 0 | 900 | 300 | 600 |
| 1 | 850 | 325 | 525 |
| 2 | 800 | 350 | 450 |
| 3 | 750 | 375 | 375 |
| 4 | 700 | 400 | 300 |
| 5 |  |  | 225 |
| 6 |  |  | 150 |
| 7 |  |  | 75 |
| 8 |  |  | 0 |

As shown in the table above, the difference in the amount of water in the two tanks is decreasing at a rate of 75 gallons per hour. The tanks are 300 gallons apart at 4 hours, so it will take another four hours for them to be equivalent – a total of 8 hours.

The solution can be found symbolically by setting the difference between the equations equal to 0, and then solving for x:

note the connections to the procedure of setting equations equal to each other (as shown on p. 3)



1. If you have not already done so, write an equation for each storage tank that can be used to determine the amount of water in the tank at any given number of hours.
2. Explain what the different parts of each equation mean in terms of the problem.
3. Explain what the different parts of each equation mean in terms of the graph.

The following equations can be used to model the amount of water in the tanks[[2]](#footnote-2):

Tank T: *y* = 900 – 50*x*

Tank W: *y* = 300 + 25*x*

where *x* represents the number of hours that the tanks have been leaking or filling up and *y* represents the number of gallons of water that are in the tank at *x* hours

The 900 means that at 0 hours, Tank T contained 900 gallons of water. The point (0, 900) is seen on the graph. The -50 means that Tank T was leaking at a rate of 50 gallons per hour. This can be seen in the graph as a line that decreases 50 gallons each hour. The 300 means that at 0 hours, 300 gallons of water was in Tank W. The + 25 means that Tank W was filling up at a rate of 25 gallons per hour.

1. Adapted from NAEP Released Items, 2003-8M10 #13. <http://nces.ed.gov/NationsReportCard/nqt> [↑](#footnote-ref-1)
2. Note that other equations are possible [e.g., 850 – 50(x – 1) for Tank T; 325 + 25(x – 1) for Tank W]. [↑](#footnote-ref-2)