Math 141 Name: SOLUTION

Homework 1

1. At age 3, little Joey was 3 feet tall. By age 5, he had grown to 3 feet, 5 inches.

   (a) Assuming linear growth, how tall do you expect Joey to be at age 8?

Joey is growing at a rate of $5\text{ in}/2\text{ year} = 2.5\text{ in}/\text{year}$

So his height at age 8 will be

$$3'5'' + (2.5'' \times 3) = \boxed{4'\tfrac{1}{2}''}$$

   (b) Write an approximate linear formula for Joey's expected height at age x.

His height will be approximately

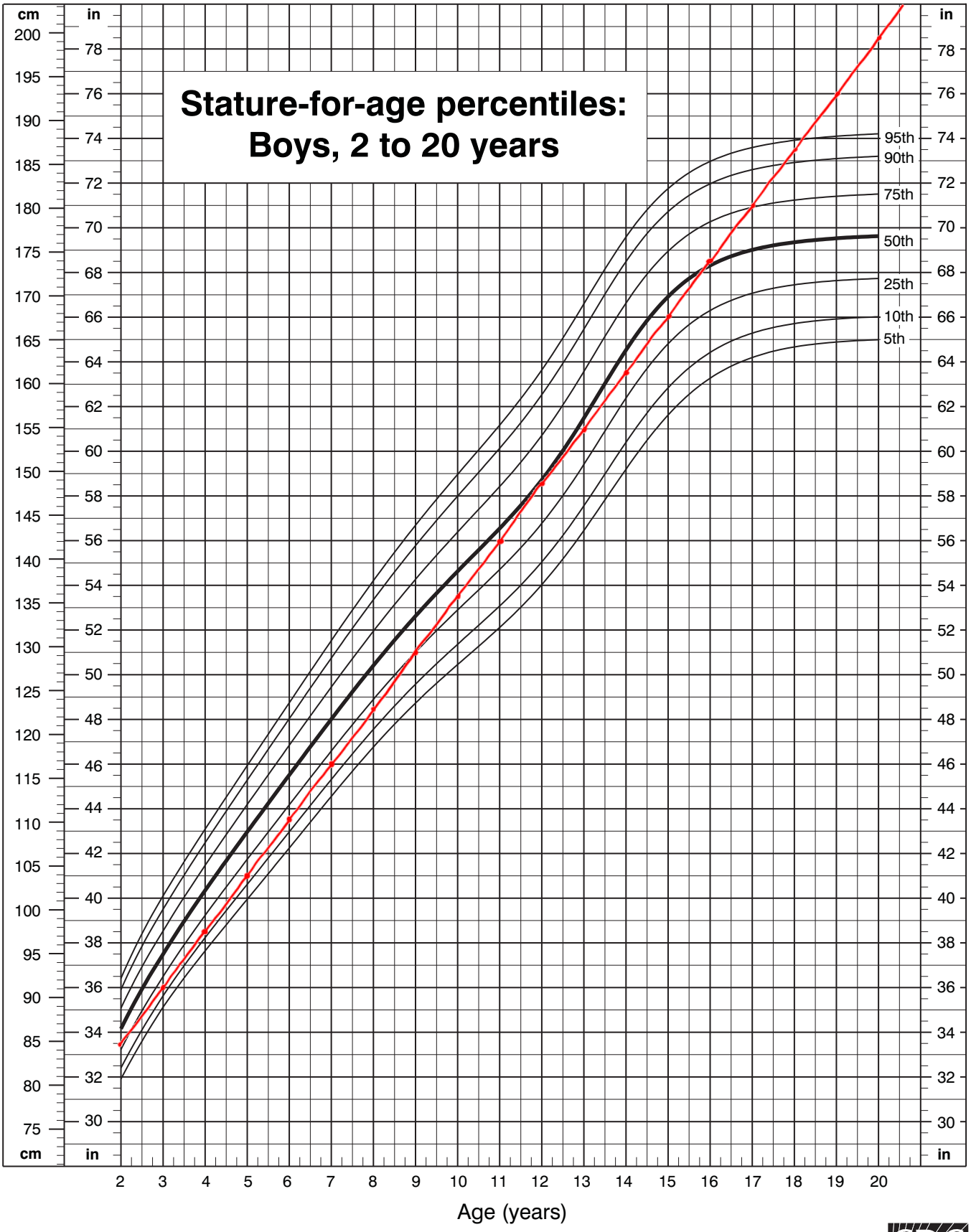
$$\boxed{41 + 2.5(x-5) \text{ inches}}$$

   (c) Use the Internet to find a pediatric growth chart for boys in the United States, ages 2 to 20. Print out the chart, and graph the line you found in part (b) on top of it. **Attach the result to your homework.**

   (d) Based on your graph from part (c), for what range of ages is the linear approximation you found in part (b) likely to be accurate? Explain.

Based on the graph, the linear approximation is likely to be very accurate up to age 8. It will probably be a few inches too high for ages 9–16, and will be completely inaccurate after age 16.

CDC Growth Charts: United States



Published May 30, 2000.

SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).

CDC

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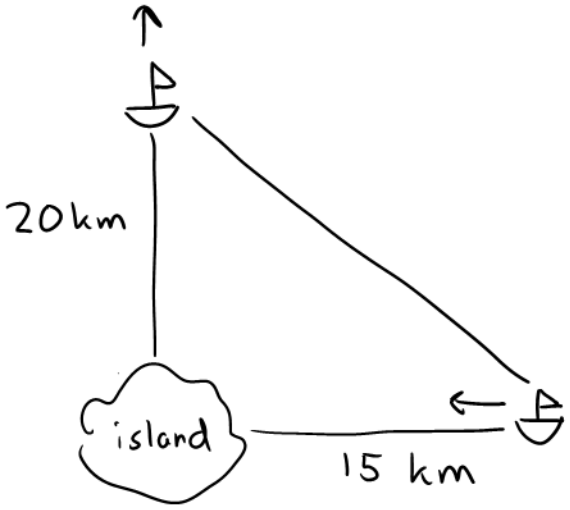
2. At 12:00 noon, a boat departs from an island and sails north with a speed of 20 km/h. At the same time, a second boat is 30 km due east of the island, and is sailing west at a speed of 15 km/h.

   (a) Draw a picture showing the locations of the two boats at 1:00 pm. Make sure to indicate the distance from each boat to the island.



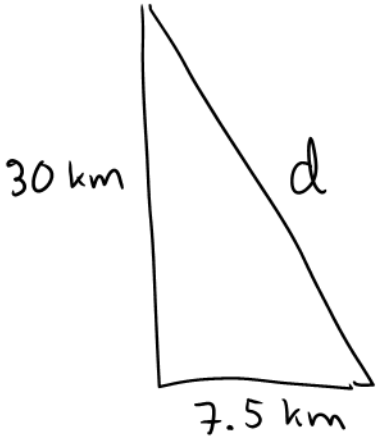
   (b) How far apart are the two boats at 1:00 pm?

Pythagorean Theorem:

$(15\text{ km})^2 + (20\text{km})^2 = d^2$

so $d = \boxed{25\text{ km}}$

   (c) How far apart will the two boats be at 1:30 pm?



$d^2 = (30\text{ km})^2 + (7.5\text{ km})^2$

so $d = \boxed{30.92\text{ km}}$

Let t be the time in hours since 12:00 noon.

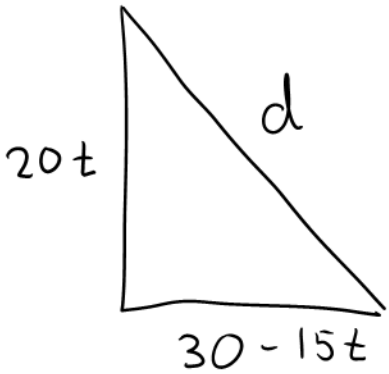
(d) Find a formula for the distance from the first boat to the island at time t.

$$\boxed{20t \text{ km}}$$

(e) Find a formula for the distance from the second boat to the island at time t.

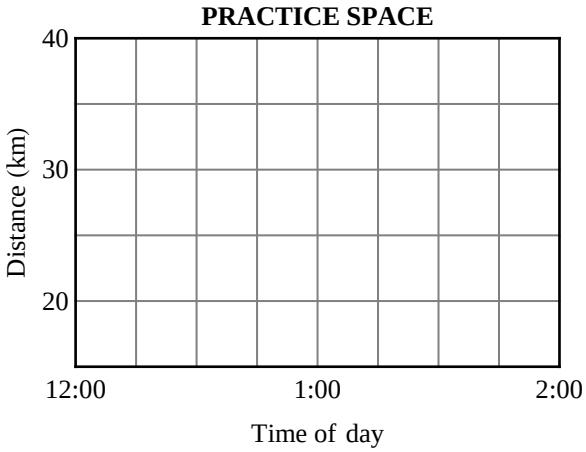
$$\boxed{30 - 15t \text{ km}}$$

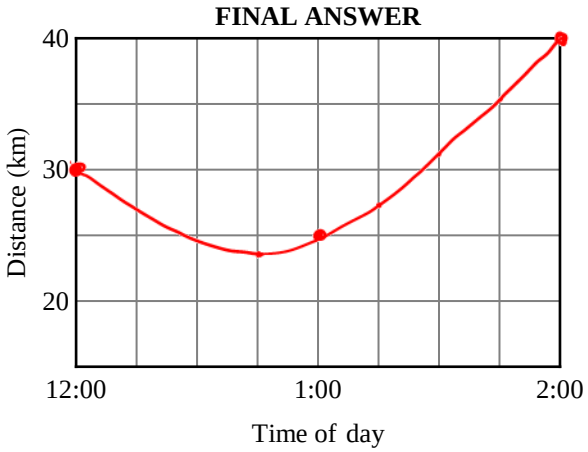
(f) Use your answers to parts (d) and (e) to find a formula for the distance between the two boats at time t. Make sure that your formula agrees with your answers to parts (b) and (c)



$$d = \boxed{\sqrt{(30-15t)^2 + (20t)^2} \text{ km}}$$

(g) Use the following axes to draw a careful graph of the distance between the two boats. Feel free to use a graphing calculator or computer to help you with this part.





(h) Using a graphing calculator or computer, determine the time at which the two boats are closest together. Your answer should be correct to the nearest minute (e.g. 1:17 pm).

$t = 0.72$ hours

$= 43.2$ minutes

12:43 pm

(i) For what times is the distance between the two boats decreasing? For what times is the distance increasing?

The distance is decreasing from 12:00 pm to 12:43 pm, and increasing from 12:43 pm to 2:00 pm.