Chapter 1

My first chapter

In this chapter of the text, we investigate several different standard things that we need to do in writing an MBX text, including how to include graphics, use knowls, and include exercises.

1.1 Graphics and other Basics

In this section of the text, we are trying to understand some basic MBX features, including

- how to make an unordered list
- how to effectively use Sublime
- how to use math mode to write things like $f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$
- how to include graphics and resize them

1.1.1 Including Graphics

To include a plot, we need to use the PDF to SVG utility (pdf2svg), and even before that need to use epstopdf. I need to learn more about how all this works with HomeBrew from the Terminal line. Should we use the filename (which is sort of a title) as the label, too?

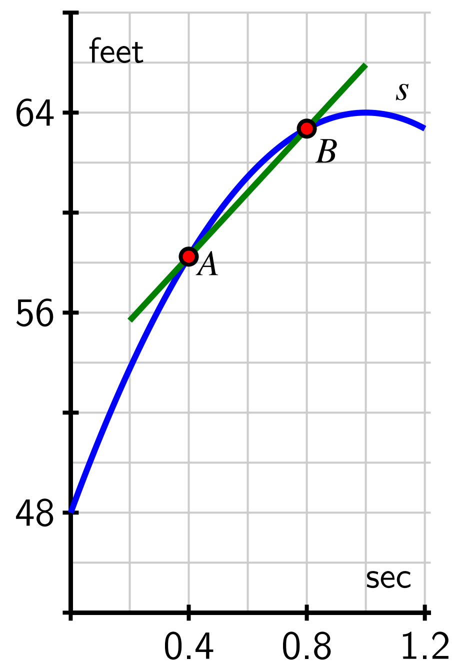


Figure 1.1.1: This is the caption for the figure.

I need to think carefully about how subsections will be structured.

How will we address the size of graphics?

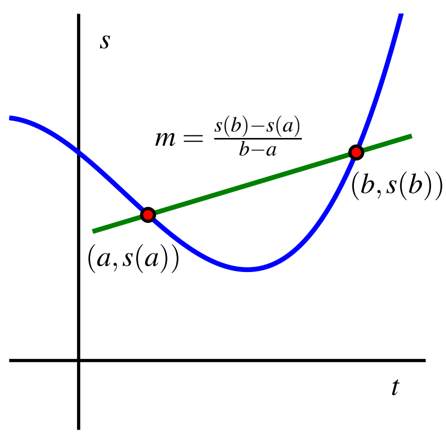
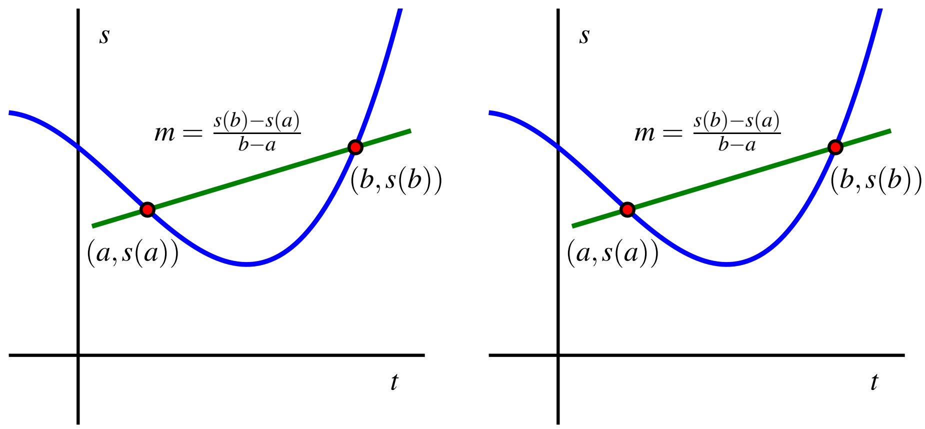


Figure 1.1.2: Is this figure smaller?

1.1.2 This is the title of my second subsection

This is text in the second subsection, and below is an example of a side-by-side figure.



(a) **(b)**

Figure 1.1.3: Side-by-side Figure, with subfigure children.

1.2 Using Knowls

In this section of the text, we will explore the use of **knowls**.

1.2.1 Things that are automatically knowl-ized

Footnotes are even better as knowls.[1]

If we do a theorem that has a proof, the proof is automatically in a knowl. The theorem structure in MBX also has several key levels/components: theorem, title, index, statement, proof.

Theorem 1.2.1 (My Theorem)**.** *If a triangle has sides of length a, b, and c, and $a^2 + b^2 = c^2$, then the triangle is a right triangle.*

Proof. Here is my insightful argument. □

Examples are also automatically put into knowls.

Example 1.2.2. Here is an example application of Theorem 1.2.1. Suppose that we have a triangle whose sides are of length 5, 12, 13. Then, since $5^2 + 12^2 = 25 + 144 = 169 = 13^2$, it follows that the triangle must be a right triangle.

1.2.2 How do exercises work?

Exercises seem to be set up so that they appear as their own section. Can we put them within a subsection? Is this one of the things Rob is working on?

1.3 Using Activities

In this section of the text, we will explore the use of **activities** and think about issues like how we deal with there not yet being an "activities" environment in MBX and where to put solutions. Really, how are activities different from exercises?

[1] Because they appear adjacent to the footnote in the text when you click on them.

1.3.1 How does the exercise environment work?

Exercises seem to be set up so that they appear as their own section. Can we put them within a subsection? Is this one of the things Rob is working on?

Exercises also, when included in the "exercises" environment, appear with their full statement included. When included as a single "exercise", such as the one following, appear as knowls.

Exercise 1.3.1 (Essay Question: Compare and Contrast)**.** Write a short paragraph that compares and contrasts the definite and indefinite integral. This is an exercise that sits in the midst of the narrative, so is formatted more like an example or a remark. It can have a hint and a solution, but this one does not. It can have a title, which this one does.

Hint. Start writing!

I wonder if all activities could just be called exercises. Or if Rob is open to having an environment identical to "exercise" that's called "activity".

Here is an activity directly from *Active Calculus*.

Exercise 1.3.2 (Car on a straight road)**.** The position of a car driving along a straight road at time t in minutes is given by the function $y = s(t)$ that is pictured in Figure 1.3.3. The car's position function has units measured in thousands of feet. Remember that you worked with this function and sketched graphs of $y = v(t) = s'(t)$ and $y = v'(t)$ in a previous activity .

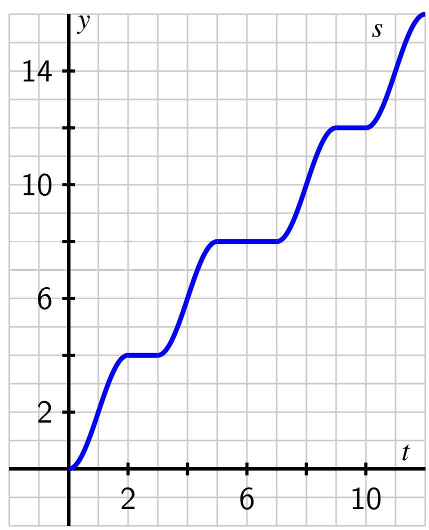


Figure 1.3.3: The graph of $y = s(t)$, the position of the car (measured in thousands of feet from its starting location) at time t in minutes.

1. On what intervals is the position function $y = s(t)$ increasing? decreasing? Why?

2. On which intervals is the velocity function $y = v(t) = s'(t)$ increasing? decreasing? neither? Why?

3. *Acceleration* is defined to be the instantaneous rate of change of velocity, as the acceleration of an object measures the rate at which the velocity of the

object is changing. Say that the car's acceleration function is named $a(t)$. How is $a(t)$ computed from $v(t)$? How is $a(t)$ computed from $s(t)$? Explain.

4. What can you say about s'' whenever s' is increasing? Why?

5. Using only the words *increasing*, *decreasing*, *constant*, *concave up*, *concave down*, and *linear*, complete the following sentences. For the position function s with velocity v and acceleration a,

   - on an interval where v is positive, s is .
   - on an interval where v is negative, s is .
   - on an interval where v is zero, s is .
   - on an interval where a is positive, v is .
   - on an interval where a is negative, v is .
   - on an interval where a is zero, v is .
   - on an interval where a is positive, s is .
   - on an interval where a is negative, s is .
   - on an interval where a is zero, s is .

Hint. Exercises (and presumably activities) can have hints.

Solution. And some exercises/activities will have solutions

I need to understand how to make the "solution" and "answer" options not appear with the exercise/activity, and yet to have these available at the end.

1.3.2 How does the new "Activity" environment work?

Rob instantiated this feature at my request in mid-June 2016.

Activity 1.3.1 (An Example of an Activity)**.** An `activity` behaves identically to `examples`; they may have an independent numbering scheme. There does not appear to be a "solution" feature; need to learn how to keep these separate.

Here is a hint to the activity

If I want to provide an answer to an activity, I can.

Solution. Is there a solution? If yes, how do I make it appear elsewhere?

1.4 Exercises

1. This is the statement of my first exercise.

Hint.
And this is a hint.

2. Suppose that an object moving along an axis has instantaneous velocity $v(t) = 2t-3$ and its position at time $t = 1$ is $s(1) = -1$. What is the position of the object at $t = 5$?

Hint. Don't forget that the velocity function is the derivative of position.

Answer. $s(5) = 11$

Solution. Since $v(t) = 2t-3$, it follows that $s(t) = t^2-3t+C$. Moreover, because $s(1) = -1$, we see that $-1 = 1^2 - 3 \cdot 1 + C$, co $C = 1$. Thus, $s(t) = t^2 - 3t + 1$, and $s(5) = 11$.

3. Here's one more new exercise.

Answer. 7

4. Here's a second exercise, but without a hint.

5. Next I'm going to try to add a WeBWorK exercise via PCC's server:

```
Library/Rochester/setIntegrals4FTC/S05.03.FundThmCalc.PTP01.pg

Seed:
```

6. Here's a second WeBWorK exercise, borrowing from a Math 201 def file.

```
Library/Michigan/Chap3Sec4/Q47.pg

Seed:
```

Appendix A

Hints and Solutions to Selected Exercises

1.4 Exercises

1. This is the statement of my first exercise.

And this is a hint.

2. Suppose that an object moving along an axis has instantaneous velocity $v(t) = 2t - 3$ and its position at time $t = 1$ is $s(1) = -1$. What is the position of the object at $t = 5$?

Don't forget that the velocity function is the derivative of position.

$s(5) = 11$

Since $v(t) = 2t - 3$, it follows that $s(t) = t^2 - 3t + C$. Moreover, because $s(1) = -1$, we see that $-1 = 1^2 - 3 \cdot 1 + C$, co $C = 1$. Thus, $s(t) = t^2 - 3t + 1$, and $s(5) = 11$.

3. Here's one more new exercise.

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