MATH 152 Assignment 5, Fall 2026.

Webassign Exercises

8.1 Exercises 9, 11

10.2 Exercises 7, 39, 47

11.1 Exercises 7, 20, 29, 31, 82.

Written Exercises

1 (Section 7.6) Question 9 (a) on Assignement 2 asked you to use Wolfram Alpha to calculate $\int \sin x \cos x dx$. The output from Wolfram Alpha is $-\frac{1}{2}\cos^2 x$. I tried Maple. Maple outputs $\frac{1}{2}\sin^2 x$. Notice $-\frac{1}{2}\cos^2 x \neq \frac{1}{2}\sin^2 x$ since $\cos(0) = 1$ but $\sin(0) = 0$. So which answer is correct? Explain. What does Gemini (google) output?

2 (Section 7.6) The Sine integral $\mathrm{Si}(x)$ is defined by $\mathrm{Si}(x) = \displaystyle\int_0^x \frac{\sin t}{t} dt$.

(a) What is $\mathrm{Si}(0)$?

(b) Let $f(t) = \sin(t)/t$. Show that $f(t)$ is an even function.

(c) Sketch $f(t) = \sin(t)/t$ for $-\pi \leq t \leq \pi$ and shade in the area $\mathrm{Si}(1)$.

(d) Calculate $\mathrm{Si}(1)$ using Simpson's rule with $n = 2$ subintervals.
How many decimal places are correct.

(e) Show that $\mathrm{Si}(-x) = -\mathrm{Si}(x)$. Start with $\mathrm{Si}(-x) = \int_0^{-x} \frac{\sin t}{t} dt$. You can apply part (b).

(f) Find $\mathrm{Si}'(x)$. Hint: apply the FTC part 1.

(g) Find $\int \mathrm{Si}(x) dx$. Hint: use integration by parts.

For this question use Wolfram Alpha as needed. Don't upload any screenshots.
See my lecture notes on Canvas for 7.6 on the error function $\mathrm{erf}(x)$.

3 (Section 8.1) Express the length of $y = \sin x$ for $0 \leq x \leq \pi$ as a definite integral. You won't be able to find an antiderivative by hand so just use Wolfram Alpha to evaluate the indefinite integral. Ask for 10 digits of precision. Upload a screenshot.

4 (Section 8.1) The equation of a circle of radius r centered at the origin is $x^2 + y^2 = r^2$. Sketch the circle. Now express the length of the top half of the circle as a definite integral. Evaluate the integral using a trig substitution. You should get πr. Conclude that the perimeter of the circle is $2\pi r$.

5 (Section 10.2) Consider the parametric curve $x = t^3 + 1, y = 2t - t^2$. Sketch the curve for $0 \leq t \leq 2$. For what value of t is $\frac{dy}{dx} = 0$. Identify the point in your sketch. Calculate the area between $y(x)$ and the x axis.

6 (Section 10.2) Consider the parameteric curve given by $x = 2\cos t, y = \sin t$ for $0 \leq t \leq 2\pi$. Use Wolfram Alpha to draw the curve. You will get an ellipse. Express the length of the curve (the circumference of the ellipse) as a definite integral and use Wolfram Alpha to evaluate the definite integral. I get 9.6884. Upload screenshots of your Wolfram Alpha work.

7 (Section 11.1) Consider the sequence given by $a_n = n^2 - 2n - 3$ for $n = 1, 2, 3, \ldots$. Give the first 6 terms of the sequence. Is the sequence

(a) increasing?

(b) decreasing?

(c) monotonic?

(d) bounded above?

(e) bounded below?

(f) bounded?

See Definitions 10 and 11. No justification needed.

8 (Section 11.1) Consider the three sequences $\{a_n\}$, $\{b_n\}$ and $\{c_n\}$ generated by $a_n = 2 + (4/3)^n$, $b_n = 2 + (3/4)^n$ and $c_n = 2 + \ln(n+1) - \ln(n)$.

(a) Calculate the terms for $n = 1, 2, 5, 10, 20$ to 5 decimal places.
Do the sequences $\{a_n\}$, $\{b_n\}$, and $\{c_n\}$ converge or diverge?

(b) Justify your answer to part (a) by taking a limit.