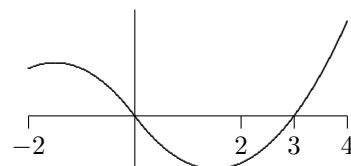
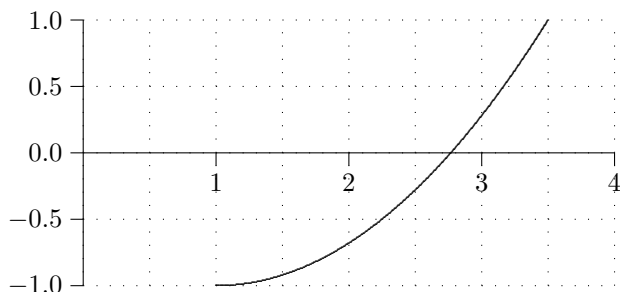


Math 131 PracTest 1

- State the Mean Value Theorem and draw a graph that illustrates.
 - Name an important theorem where the Mean Value Theorem was used in the proof.
 - State the definition of the definite integral of a continuous function on a closed interval $[a, b]$.
 - Draw a picture that illustrates the Mean Value Theorem for Integrals.
- Draw and then estimate R_5 for the graph of f on $[1, 3.5]$ on the left below. Be careful of the scale.



- In the graph of f on the right above, assume that $\int_{-2}^4 f(x) dx = 1$, $\int_{-2}^0 f(x) dx = 3$, and $\int_{-2}^3 f(x) dx = -1.2$. Evaluate the following.

a) $\int_3^4 f(x) dx$ b) $\int_0^3 f(x) dx$ c) $\int_{-2}^4 2f(x-1) dx$ d) $\int_{-2}^0 f(x) - 4 dx$

e) If $f(x)$ is symmetric about the origin, what is $\int_0^2 f(x) dx$?

- Calculate these “look-alike” indefinite integrals.

a) $\int \sqrt{4t-1} dt$ b) $\int \frac{1}{\sqrt{1-4t^2}} dt$ c) $\int \frac{t}{\sqrt{1-4t^2}} dt$ d) $\int t\sqrt{4-t} dt$
 e) $\int \frac{t}{1+4t^4} dt$ f) $\int \frac{t^3}{1+4t^4} dt$ g) $\int \frac{t^2}{1+4t^6} dt$ h) $\int \frac{1+4t^6}{t^2} dt$

- If an antiderivative of $f(x)$ is $\sin x - x \sin x + 1$, what was $f(x)$?
 - On a recent test Judy said that $\int 2 \cos x \sin x dx = \sin^2 x + c$. Elaine said that $\int 2 \cos x \sin x dx = -\cos^2 x + c$. I gave them both full-credit. How can both be correct if their answers are different? Did I make a mistake?

- a) Fill in the table for R_n for $\int_1^3 3(x^2 - 1) dx$. Be sure to simplify $f(x_k)$.

$f(x)$	$[a, b]$	Δx	x_k	$f(x_k)$	R_n

- If you were to graph $f(x)$ on $[1, 3]$ it would be an increasing function. Is R_n an over or under estimate of $\int_1^3 3(x^2 - 1) dx$? Explain.
- Find $\int_1^3 3(x^2 - 1) dx$ using a limit of Riemann sums. Check your answer by evaluating $\int_1^3 3(x^2 - 1) dx$ using the FTC.
- Think: On a test once, I asked students to compute R_{100} and R_{200} for $f(x) = e^x$ on an interval $[a, b]$. A student correctly computed both with his calculator but failed to label which is which. Which of her two values is R_{100} : 47.6828 or 47.4455? **Explain** clearly how you can tell.

7. Determine these antiderivatives

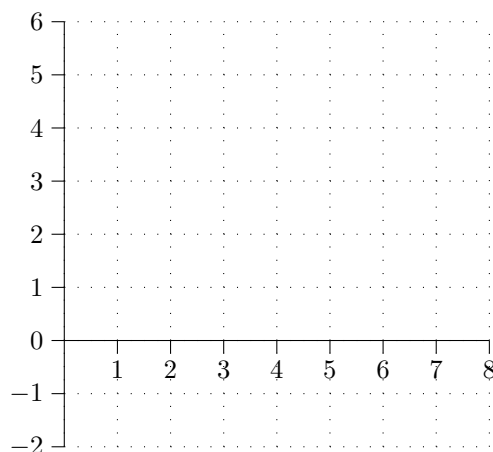
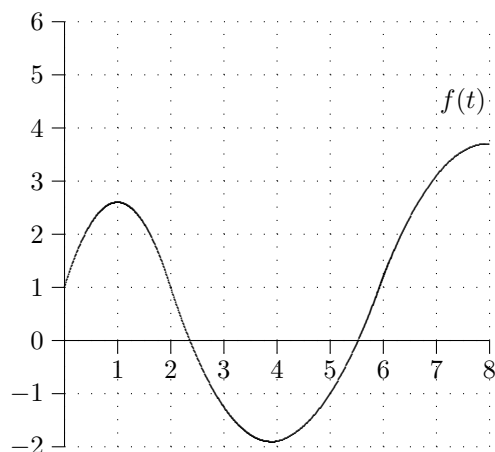
- a) $\int 8 \sec(4\pi x) \tan(4\pi x), dx$ b) $\int \frac{e^{\sqrt{t}}}{\sqrt{t}} dt$ c) $\int \sin(\sin t) \cos t dt$ d) $\int \frac{e^x + e^{-x}}{e^x - e^{-x}} dx$
- e) Evaluate $\int_0^1 \frac{e^x + e^{-x}}{e^x - e^{-x}} dx$.

8. The graph of $f(x)$ is given below on the left. Answer the following questions about $F(x) = \int f(x) dx$.

- a) On what interval(s) is F increasing? Explain.
 b) At what point(s), if any, does F have a local min? Explain.
 c) On what interval(s) is F concave down? Explain.
 d) Does F have any points of inflection? Explain.
 e) Fill in the the table below. Your values should be reasonably accurate.

b	0	1	2	3	4	5	6	7	8
$F(b) = \int_0^b f(t) dt$									

f) Graph $F(x)$ on the axes on the right using your table values.



9. **Think and Interpret:** The velocity of an object $v(t)$ in m/s is graphed above on the left (same graph as in previous question).

- a) When is the object moving backwards? Explain.
 b) When is acceleration negative? Explain.
 c) Assume that the initial position of the object is $s(0) = 0$. Fill in the row in the table for the position $s(t)$ for the object. Then graph the position function on the axes above on the right.

t	0	1	2	3	4	5	6	7	8
Position $s(t)$									
Distance Traveled = $\int_a^b v(t) dt$									

- d) What is v_{ave} ? (Hint: Use the v_{ave} formula and your work above.) At what time(s) t did v_{ave} occur? Explain.
 e) This won't be on the test, but you can hand it in Monday for **extra credit**. Speed is $|v(t)|$. Graph the speed function for the object on the axes on the left.
 f) **Extra credit.** Distance traveled is the integral of the speed: $\int_a^b |v(t)| dt$. Fill in the row in the table above for the distance traveled by the object.

10. a) An oil supertanker traveling at 16 knots (1 knot is 1.6875 ft/s) requires 3 nautical miles (1 nautical mile is 6080 ft) to stop with the engines in full-reverse. Find the deceleration for the tanker, assuming this rate is constant. Hint: Convert all units to feet. [Ans: $a = -\frac{729}{36480}$ ft/s²]
- b) How much time passes during this process?
11. My Honda Accord accelerates from 0 to 88 ft/sec (60 mph) in 13 seconds. Assume that the acceleration is a constant, a .
- a) Find the velocity function of the car (using the velocities at the two times you can eliminate any constants from this function).
- b) How far does it travel in this 13 second period?