# Symbolic Integration Assignment

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## 1 Symbolic Integration Assignment

### 1.1 Question 0

[1 point] Watch the lecture video here.
Did you watch the video? [Type yes or no.]

### 1.2 Question 1

[4 points] Compute the following integrals using the integral command.

#### 1.2.1 Part a

$$\int \sin(3x)\sin(2x)\,dx$$

#### 1.2.2 Part b

$$\int e^{5t}\sin(4t)\,dt$$

#### 1.2.3 Part c

$$\int_0^{\pi/2} \big(\sin(ax)\big)^2\,dx$$

#### 1.2.4 Part d

$$\int_1^5 \frac{\ln(x)}{x^2}\,dx$$

## 1.3 Question 2

[1 point] Use the numerical_integral command to compute $\int_0^1 x\tan(x)\,dx$

## 1.4 Question 3

[1 point] The velocity at time $t$ of a particle travelling in a straight line is given by the equation $v(t) = 3t^3 - 4t^2 + 10$. How far does the particle travel from $t = 10$ to $t = 20$?

[Hint: Distance traveled is the integral of velocity.]

## 1.5 Question 4

[1 point] Let $f(x) = 2x\sqrt{1 - x^3}$.

### 1.5.1 Part a

Find the area between the graph of $f$ and the x-axis from $x = 0$ to $x = 1$. Convert Sage's answer to a decimal.

### 1.5.2 Part b

Estimate the area in Part a using left and right Riemann sums with $n = 100$ subintervals.

## 1.6 Question 5

[1 point] We are going to compute $\frac{d}{dx}\int_x^{\sin(x)} 3t^2\,dt$ in two ways.

### 1.6.1 Part a

Use the derivative and integral commands to calculate $\frac{d}{dx}\int_x^{\sin(x)} 3t^2\,dt$.

### 1.6.2 Part b

The Fundamental Theorem of Calculus implies that $\frac{d}{dx}\int_{g(x)}^{h(x)} f(t)\,dt = f(h(x)) \cdot h'(x) - f(g(x)) \cdot g'(x)$.

With $f(t) = 3t^2$, $h(x) = \sin(x)$, and $g(x) = x$, calculate $f(h(x)) \cdot h'(x) - f(g(x)) \cdot g'(x)$. [You should get the same answer as part a.]

## 1.7 Question 6

[1 point] We are going to compute $\int_5^{10} \frac{d}{dx}\frac{5}{1 - x^2}\,dx$ in two ways.

### 1.7.1 Part a

Use the integral and derivative commands to calculate $\int_5^{10} \frac{d}{dx} \frac{5}{1-x^2}\, dx$.

### 1.7.2 Part b

The Fundamental Theorem of Calculus implies that $\int_a^b \frac{d}{dx} f(x)\, dx = f(b) - f(a)$.

With $f(x) = \frac{5}{1-x^2}$, calculate $f(10) - f(5)$. [You should get the same answer as part a.]