Given that $\int_0^{\pi} \sin x\,dx = 2$ and what you know about areas and integrals, find the following integrals.

1. $\int_{\pi}^{2\pi} \sin x\,dx = -2$
2. $\int_{0}^{2\pi} \sin x\,dx = 0$
3. $\int_{0}^{\pi/2} \sin x\,dx = 1$
4. $\int_{0}^{\pi} (2+\sin x)\,dx = 2 + 2\pi$
5. $\int_{0}^{\pi} 2\sin x\,dx = 4$
6. $\int_{2}^{\pi+2} \sin(x-2)\,dx = 2$
7. $\int_{-\pi}^{\pi} \sin u\,du = 0$
8. $\int_{0}^{2\pi} \sin(x/2)\,dx = 4$
9. $\int_{0}^{\pi} \cos x\,dx = 0$

10. Suppose k is any positive number. Make a conjecture about $\int_{-k}^{k} \sin x\,dx$ and support your conjecture. 0

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Homework Questions

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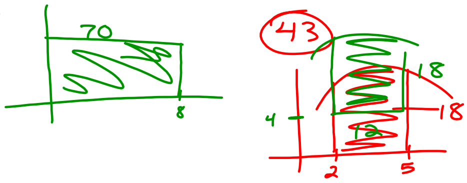

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5-3 Definite Integrals and the Mean Value Theorem

Learning Objectives:

I can use the properties of definite integrals to evaluate integrals.

I can find the average value of a function.

I can apply the Mean Value Theorem (part 2) to find the location where a function takes on the average value.

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Rules for Definite Integrals

1.) $\int_b^a f(x)\,dx = -\int_a^b f(x)\,dx$

2.) $\int_a^a f(x)\,dx = 0$

3.) $\int_a^b k\cdot f(x)\,dx = k\cdot\int_a^b f(x)\,dx$

$\int_0^{\pi} 2\sin x\,dx$

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4.) $\int_a^b [f(x)dx + g(x)]dx = \int_a^b f(x)\,dx + \int_a^b g(x)\,dx$

5.) $\int_a^b f(x)\,dx = \int_a^c f(x)\,dx + \int_c^b f(x)\,dx$

6.) If f_{min} = min value of f(x) on [a,b] and
f_{max} = max value of f(x) on [a,b], then

$$f_{\min}(b-a) \le \int_a^b f(x)\,dx \le f_{\max}(b-a)$$

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7.) f(x) $\leq$ g(x) for all x on [a,b], then

$$\int_a^b f(x)dx \leq \int_a^b g(x)dx$$

8.) f(x) $\geq$ 0 for all x on [a,b], then $\int_a^b f(x)dx \geq 0$

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Ex1. $\int_{-2}^{1} f(x)dx = 3$, $\int_{1}^{3} f(x)dx = 7$, $\int_{1}^{3} g(x)dx = -3$

Find:

5 $\int_1^3 (2f(x) + 5g(x))dx$

$2 \cdot 7 \quad 5 \cdot -3$

$14 + -15 = -1$

1.) $\int_{-2}^{3} f(x)dx = 10$

2.) $\int_{3}^{1} f(x)dx = -7$

3.) $\int_{1}^{3} 3f(x)dx = 21$

4.) $\int_{1}^{3} [f(x) + g(x)]dx = 4$

5.) $\int_{1}^{3} [2f(x) + 5g(x)]dx$

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Ex2. Find the upper and lower bounds for $\int_0^2 e^x dx$

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Average (Mean) Value of a Funcon

If f(x) is integratable on [a,b], its Average (Mean) Value on [a,b]

$$MV = \frac{1}{b-a}\int_a^b f(x)dx$$

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Mean Value Theorem (Part 2) forDefinite Integrals

If f(x) is connuous on [a,b], then at some point c in [a,b]

$$f(c) = \frac{1}{b-a}\int_a^b f(x)dx$$

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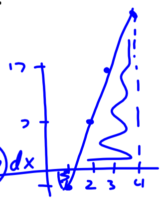
Ex4. If $f(x) = x^2 + 5x - 7$ on [1,4].

Find a value of ***c*** on [1,4] such that:

$$f(c) = \frac{1}{b-a}\int_a^b f(x)dx$$



$f(c) = \frac{1}{4-1}\int_1^4 (x^2+5x-7)dx$

$= 12.5$

$12.5 = x^2 + 5x - 7$

$c = 2.574$

$y_1 = x^2 + 5x - 7$

$y_2 = 12.5$

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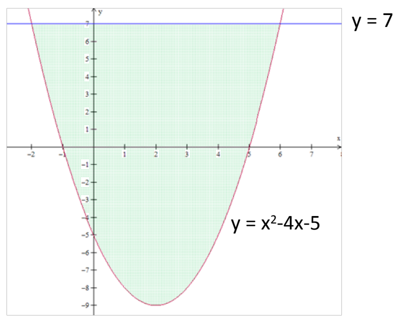
Ex5. Find the shaded area.



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Homework

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