MA 16010 LESSON 34: NUMERICAL INTEGRATION
(Examples w/ Solutions)

EX 1: Use the Trapezoid Rule to approximate $\int_0^3 x^2\,dx$ using $n = 3$. Round your answer to the nearest tenth.

Solution: (1) First calculate Δx.

$a = 0$

$b = 3$

$b - a = 3 - 0 = 3$

$\Delta x = \dfrac{b-a}{n} = \dfrac{3}{3} = 1$

(2) Determine what $f(x)$ is.

$$\int_0^3 \boxed{x^2}\,dx$$

Hence $f(x) = x^2$

(3) Find the following values:

x_0	=	0	$f(x_0)$	=	0	$f(x_0)$	=	0
x_1	=	1	$f(x_1)$	=	1	$2 \cdot f(x_1)$	=	2
x_2	=	2	$f(x_2)$	=	4	$2 \cdot f(x_2)$	=	8
x_3	=	3	$f(x_3)$	=	9	$f(x_3)$	=	9

(4) Sum all the values in the black box. $= 19$

(5) Multiply the value found in (4), Δx found in (1), and 1/2, which yields our answer.

$19 \times 1 \times \frac{1}{2} = \frac{19}{2}$

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EX 2: Approximate the area of the shaded region by using the Trapezoid Rule with $n = 3$

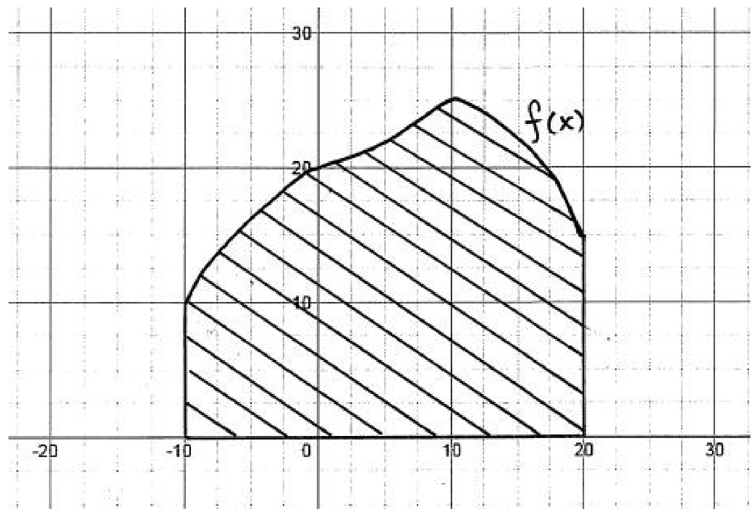
Solution: (1) First calculate Δx.

a = -10

b = 20

$b - a$ = $20-(-10)=30$

$\Delta x = \dfrac{b-a}{n}$ = $\dfrac{30}{3}=10$



(2) Find the following values:

x_0 = -10	$f(x_0)$ = 10		$f(x_0)$ = 10
x_1 = 0	$f(x_1)$ = 20		$2 \cdot f(x_1)$ = 40
x_2 = 10	$f(x_2)$ = 25		$2 \cdot f(x_2)$ = 50
x_3 = 20	$f(x_3)$ = 15		$f(x_3)$ = 15

(3) Sum all the values in the black box. = 115

(4) Multiply the value found in (4), Δx found in (1), and 1/2, which yields our answer.

$115 \times 10 \times \frac{1}{2} = 575$