Riemann Sums and Over/Underestimates

1. Sketch each sum using the given points. Shade in the definite integral.

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Increasing and Concave Up					
Left Sum "L"	Right Sum "R"	Trapezoidal "T"	Integral "I"		
$\begin{array}{c} \downarrow \\ \downarrow \\ \downarrow \\ \downarrow \\ \end{array}$	x x	x x	$\begin{array}{c} \downarrow \\ \downarrow \\ \downarrow \\ \downarrow \\ \end{array}$		

Which of the following correctly orders the sums from least to greatest?

- (a) L < R < T < I
- (b) R < I < T < L
- (c) L < I < T < R

- (d) R < T < I < L
- (e) L < T < I < R

2. Sketch each sum using the given points. Shade in the definite integral.

Increasing and Concave Down					
Left Sum "L"	Right Sum "R"	Trapezoidal "T"	Integral "I"		
1 ^ y	1 ^ y	1 ^ y	1 ^ y		
\xrightarrow{x}	$X \longrightarrow X$	X	$\frac{x}{x}$		

Which of the following correctly orders the sums from least to greatest?

- (a) L < R < T < I
- (b) R < I < T < L
- (c) L < I < T < R

- (d) R < T < I < L
- (e) L < T < I < R

3. Sketch each sum using the given points. Shade in the definite integral.

5. Sketch each sum using the given points. Shade in the definite integral.					
Decreasing and Concave Down					
Left Sum "L"	Right Sum "R"	Trapezoidal "T"	Integral "I"		
1 ^ y	1 ^ y	1 ^ y	1 ^ y		
$\stackrel{\times}{\longleftarrow}_{x}$	χ	X	$x \rightarrow x$		

Which of the following correctly orders the sums from least to greatest?

- (a) L < R < T < I
- (b) R < I < T < L (c) L < I < T < R

- (d) R < T < I < L
- (e) L < T < I < R

4. Sketch each sum using the given points. Shade in the definite integral.

Decreasing and Concave Up					
Left Sum "L"	Right Sum "R"	Trapezoidal "T"	Integral "I"		
1 ^ y	1 ^ y	1 ^ y	1 ^ y		
\xrightarrow{x}	\xrightarrow{x}	\xrightarrow{x}	\xrightarrow{x}		

Which of the following correctly orders the sums from least to greatest?

- (a) L < R < T < I
- (b) R < I < T < L
- (c) L < I < T < R

- (d) R < T < I < L
- (e) L < T < I < R