

Watch. Practice. Understand. | Lesson 322

2022 Calculus BC Finding Arc Length with Integration (Rokawski 's Calculus 8.1)

Watch the matching video: <https://www.youtube.com/watch?v=FiWRtZgvlbw>

Practice focus: Arc length of curves

Original extra practice matched to the listed lesson topic.

Name: _____ Date: _____ Show your reasoning and check units.

01 Find arc length of $y=3x$ on $[0,2]$.

02 Find arc length of $y=(2/3)x^{(3/2)}$ on $[0,3]$.

03 Write an arc-length integral for $y=\sin x$ on $[0,\pi]$.

04 Explain why integrating only $y'(x)$ does not give arc length.

Worked answers | Lesson 322

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01 Find arc length of $y=3x$ on $[0,2]$.

$$L = \int_0^2 \sqrt{1+(y')^2} \, dx = \int_0^2 \sqrt{10} \, dx = 2\sqrt{10}.$$

02 Find arc length of $y=(2/3)x^{(3/2)}$ on $[0,3]$.

$$y'=\sqrt{x}. \quad L = \int_0^3 \sqrt{1+x} \, dx = (2/3)[(1+x)^{(3/2)}]_0^3 = 14/3.$$

03 Write an arc-length integral for $y=\sin x$ on $[0,\pi]$.

$$L = \int_0^\pi \sqrt{1+\cos^2 x} \, dx; \text{ a numerical method can evaluate it.}$$

04 Explain why integrating only $y'(x)$ does not give arc length.

Integral y' gives net vertical change. Arc length accumulates positive distance $\sqrt{1+(y')^2} \, dx$.