

1. Find

$$\lim_{t \rightarrow 0} (1 + 2t)^{\frac{1}{\arcsin t}}$$

points

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2. Evaluate the following integrals

5 each

(a)  $\int x \tan^{-1} x \, dx$

(b)  $\int \frac{2 + 3x}{x^4 + x^2} \, dx$

(c)  $\int \frac{1 - \sinh x}{\sqrt{1 + \sinh^2 x}} \, dx$

(d)  $\int \frac{dx}{\tan x + \sin x}$

3. Determine if the following improper integral exists or not and calculate its value if it exists.

$$\int_0^1 \frac{e^{\sqrt[3]{x}}}{\sqrt[3]{x}} \, dx.$$

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4. Find the vertex and focus and sketch the graph of the conic section

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$$y = 40x - 97 - 4x^2.$$

5. Let the curve  $C$  be given parametrically by

$$x = e^{-t} \cos t, \quad y = e^{-t} \sin t \quad (0 \leq t \leq \pi).$$

(a) Find the point(s) where the tangent line to  $C$  is vertical.

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(b) Calculate the length of  $C$ .

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