

Calculus 3 Prep Problems

Derivatives

Use the specified rule to find the derivative of each of the following problems:

Power:

1. $\frac{d}{dx} 5x^{20}$

Product:

2. $\frac{d}{dx} e^x \sin(x)$

Quotient:

3. $\frac{d}{dx} \frac{2x}{\sin(x)}$

Chain:

$$4. \frac{d}{dx} 5(x - 3)^2$$

Use the inverse function theorem, as state below, to find the derivative of the inverse of each of the following functions.

$$(f^{-1})'(x) = [f'(f^{-1}(x))]^{-1} = \frac{1}{f'(f^{-1}(x))}$$

Find $(f^{-1})'(x)$

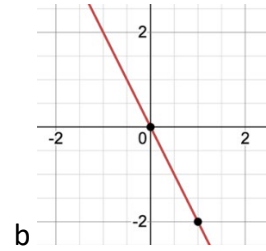
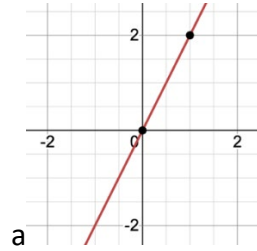
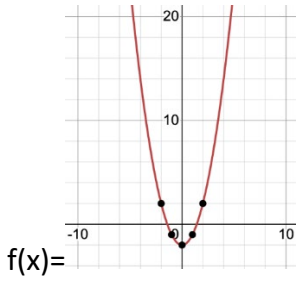
$$5. f(x) = e^x$$

$$6. f(x) = 2x^2 + 4$$

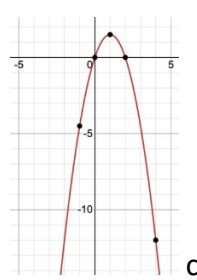
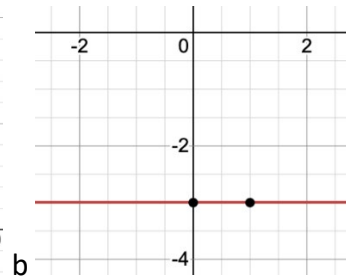
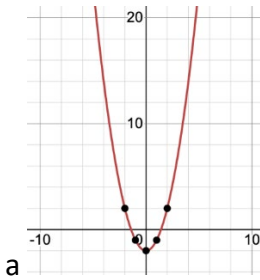
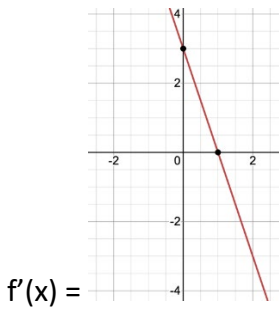
$$7. f(x) = \sin(x)$$

Graphing

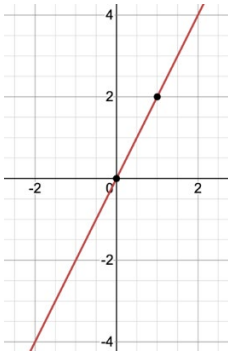
11. Which of the below graphs represents the derivative of $f(x)$?



12. Which of the below graphs represents the function $f(x)$?



13. If the function $f(x)$ is represented by the graph below, sketch a graph of $f'(x)$:



Integration

Find the integral of the following functions using the specified method:

U-Substitution

Recall rule

$$\int f(g(x))g'(x)dx = \int f(u)du, \quad u = g(x), \quad du = g'(x)$$

14. $\int 2x(x^2 + 4)^3 dx$

15. $\int \sin(x) \cos^2(x) dx$

$$16. \int \frac{2 \ln x}{x} dx$$

Integration by parts

Recall rule

$$\int \mathbf{u} \mathbf{d}v = \mathbf{u}v - \int \mathbf{v} \mathbf{d}u$$

$$17. \int x \sin(x) dx$$

$$18. \int x^2 e^x dx$$

$$19. \int x^{-3} \ln x \, dx$$

Improper integrals

$$20. \int_0^{\infty} x^2 \, dx$$

$$21. \int_1^{\infty} \frac{1}{x^2} \, dx$$

$$22. \int_{-\infty}^{\infty} \frac{1}{1+x^2} \, dx$$