

Instructor Guided Examples:

Thinking about Efficiency: For each function below, the differentiation rule(s) needed based on the way the function is written in the first column are listed in bold. P=product rule; Q=quotient rule; C=general power rule (chain rule for power functions). In the first column you will see the rules in bold that would need to be used to differentiate if the function were not rewritten. Rewrite (and if applicable, simplify) each function so that the differentiation rule listed in bold in the second column is all that is needed. **Do not differentiate.**

Function and Rule(s) needed to find derivative based on the way it is currently written:	Rewrite the function so that it can be differentiated using the rule(s) listed:
i. $f(x) = x^5 \sqrt{32x}$ = $x(32x)^{1/5}$ = $x \cdot 32^{1/5} \cdot x^{1/5}$ PC	$f(x) = 2x^{6/5}$ S
ii. $g(x) = \frac{9x^6 + 2x^4 - 7}{x^2}$ = $\frac{9x^6}{x^2} + \frac{2x^4 - 7}{x^2}$ Q	$g(x) = 9x^4 + 2x^2 - 7x^{-2}$ S
iii. $y = \frac{-13}{(7x+2)^8}$ QC	$y = -13(7x+2)^{-8}$ C
iv. $f(x) = 2x\sqrt{x} - \frac{5}{\sqrt{16x}}$ = $2x^{3/2} - \frac{5}{\sqrt{16}\sqrt{x}}$ PQ	$f(x) = 2x^{3/2} - \frac{5}{4}x^{-1/2}$ S

The answers to the questions on the following page will be entered via clicker. Your work for F, F', S, S', B, B', T, and T' will not be entered into your clicker. Only the simplified answer corresponding to the numbered boxes should be entered into the clicker. Choose from among the answer choices at the top of the next page. Note that the letters you will enter into your clicker are just text values (instead of the usual multiple choice letters you see in your clicker due to the limited number of choices available for multiple choice in the clicker software). Just be sure not to enter any extra spaces in the text space, only ONE letter per answer box and it is NOT case sensitive. Letters may be used more than once and some letters won't be used at all.

Answers must be in the form of constant (power of x) () ^{power}
(order!)

key

Use the indicated rule(s) in the given order they are listed to differentiate the function. Be sure to simplify by multiplying any monomial factors together. Use the answer choices below to enter final, simplified answers into your clicker according to the letters below. Remember, letters may be used more than once or not at all.

- A. $(4x+3)$ B. $(3x^2-1)$ C. $96x$ D. 4 E. $16x^2$ F. 6 G. ~~$4x^2$~~ H. $72x$ I. 36 J. $240x^2$
 K. ~~$\frac{12}{3}$~~ L. 9 M. 10 N. 11 O. 8 P. $10x$ Q. $\frac{2}{3}$ R. $-\frac{2}{3}$ S. $\frac{5}{3}$ T. $\frac{3}{5}$ U. $+$ V. ~~$-$~~

Use for numbers 1-7. below: $f(x) = (4x+3)^9(3x^2-1)^{12}$ PC

F, F', S, S' are for your work usage only:

F = $(4x+3)^9$ $f'(x) = (4x+3)^9(72x)(3x^2-1)^{11} + (3x^2-1)^{12}(36)(4x+3)^8$
 F' = $9(4x+3)^8(4) = 36(4x+3)^8$
 S = $(3x^2-1)^{12}$
 S' = $12(3x^2-1)^{11}(6x) = 72x(3x^2-1)^{11}$

1. 2. 3. 4. 5. 6. 7.

$$f'(x) = \boxed{72x} \boxed{4x+3}^9 (3x^2-1)^{\boxed{11}} \boxed{+} \boxed{36} \boxed{(3x^2-1)}^{12} (4x+3)^{\boxed{8}}$$

① H ② A ③ N ④ U ⑤ I ⑥ B ⑦ O ⑧

Use for numbers 8-11. below: $f(x) = \sqrt[3]{(3x^2-1)^5}$ C

8. S. $\frac{5}{3}$

REWRITE: $f(x) = (3x^2-1)^{\frac{5}{3}}$

9. 10. 11.

$$f'(x) = \boxed{10x} \boxed{(3x^2-1)}^{\frac{2}{3}} \boxed{\frac{2}{3}}$$

⑨ P ⑩ B ⑪ Q

Note to Self: $\frac{5}{3} - \frac{3}{3} = \frac{2}{3}$
 *Next semester change k. option to $-\frac{2}{5}$

There are more problems on the next page that use the same instructions and answer choices.

Key

- A. $(4x+3)$ B. $(3x^2-1)$ C. $96x$ D. 4 E. $16x^2$ F. 6 G. $10x$ H. $72x$ I. 36 J. $240x^2$
 K. 12 L. 9 M. 10 N. 11 O. 8 P. $10x$ Q. $\frac{2}{3}$ R. $-\frac{2}{3}$ S. $\frac{5}{3}$ T. $\frac{3}{5}$ U. $+$ V. $-$ W. $4x^2$

Use for numbers 12.-19. below: $f(x) = \frac{(3x^2-1)^{10}}{4x}$ **QC**

B, B', T, T' are for your work usage only:

B = $4x$
 B' = 4
 T = $(3x^2-1)^{10}$
 T' = $10(3x^2-1)^9(6x)$

$$f'(x) = \frac{4x(10)(6x)(3x^2-1)^9 - (3x^2-1)^{10}(4)}{(4x)^2}$$

$$= \frac{240x^2(3x^2-1)^9 - 4(3x^2-1)^{10}}{16x^2}$$

12. $\frac{12}{J}$ 13. $\frac{13}{B}$ 14. $\frac{14}{L}$ 15. $\frac{15}{V}$ 16. $\frac{16}{D}$ 17. $\frac{17}{B}$ 18. $\frac{18}{M}$

$$f'(x) = \frac{240x^2 (3x^2-1)^9 - 4 (3x^2-1)^{10}}{16x^2}$$

Note to self:
 * Next semester add in $4x^2$ as an option

Use for numbers 20.-26. below: $f(x) = \frac{6x}{(4x+3)^4}$ **PC**

REWRITE: $f(x) = (6x)(4x+3)^{-4}$

F, F', S, S' are for your work usage only:

F = $6x$
 F' = 6
 S = $(4x+3)^4$
 S' = $4(4x+3)^3(4) = 16(4x+3)^3$

$$f'(x) = 6x(16)(4x+3)^3 + (4x+3)^4(6)$$

$$= 96x(4x+3)^3 + 6(4x+3)^4$$

21. $\frac{21}{C}$ 22. $\frac{22}{A}$ 23. $\frac{23}{W}$ 24. $\frac{24}{F}$ 25. $\frac{25}{A}$ 26. $\frac{26}{D}$

$$f'(x) = 96x (4x+3)^3 + 6 (4x+3)^4$$