Classroom Voting Questions: Calculus I

3.3 The Product and Quotient Rules

1. \( \frac{d}{dx} (x^2 e^x) = \)
   
   (a) \( 2xe^x \)
   
   (b) \( x^2 e^x \)
   
   (c) \( 2xe^x + x^2 e^{x-1} \)
   
   (d) \( 2xe^x + x^2 e^x \)

2. \( \frac{d}{dx} (xe^x) = \)
   
   (a) \( xe^x + x^2 e^x \)
   
   (b) \( e^x + xe^x \)
   
   (c) \( 2xe^x + xe^x \)
   
   (d) \( e^x \)

3. \( \frac{d}{dt} ((t^2 + 3) e^t) = \)
   
   (a) \( 2te^t + (t^2 + 3) e^t \)
   
   (b) \( (2t + 3) e^t + (t^2 + 3) e^t \)
   
   (c) \( 2te^t \)
   
   (d) \( 2te^t + t^2 e^t \)
   
   (e) \( (t^2 + 3) e^t \)

4. \( \frac{d}{dx} (x^3 4^x) = \)
   
   (a) \( 3x^2 4^x \ln 4 \)
   
   (b) \( x^3 4^x + x^3 4^x \ln 4 \)
   
   (c) \( 3x^2 4^x + x^3 4^x \)
   
   (d) \( 3x^2 4^x + x^3 4^x \ln 4 \)
5. When differentiating a constant multiple of a function (like $3x^2$) the Constant Multiple Rule tells us $\frac{d}{dx} cf(x) = c \frac{d}{dx} f(x)$ and the Product Rule says $\frac{d}{dx} cf(x) = c \frac{d}{dx} f(x) + f(x) \frac{d}{dx} c$. Do these two rules agree?

(a) Yes, they agree, and I am very confident.
(b) Yes, they agree, but I am not very confident.
(c) No, they do not agree, but I am not very confident.
(d) No, they do not agree, and I am very confident.

6. $\frac{d}{dx} x e^x =$

(a) $e^x + xe^x$
(b) $\frac{e^x - xe^x}{e^x}$
(c) $\frac{xe^x - e^x}{e^x}$
(d) $\frac{xe^x - e^x}{e^x}$

7. $\frac{d}{dx} x^{1.5} =$

(a) $1.5x^{0.5} - 3x \ln 3$
(b) $1.5x^{0.5} - 3x^{1.5} \ln 3$
(c) $1.5x^{0.5} - 3x^{1.5} \ln 3$
(d) $1.5x^{0.5} - 3x^{1.5} \ln 3$

8. If $e^a - \frac{b}{a^2} = 5$, find $\frac{db}{da}$.

(a) $\frac{db}{da} = e^a$
(b) $\frac{db}{da} = a^2 e^a$
(c) $\frac{db}{da} = a^2 e^a - 5a^2$
(d) $\frac{db}{da} = 2ae^a + a^2 e^a - 10a$
(e) $\frac{db}{da} = 2ae^a + a^2 e^a - 10ae^a - 5a^2 e^a$
(f) Cannot be determined from this expression

9. $\frac{d}{dx} (25x^2 e^x) =$

(a) $50x^2 e^x + 25x^2 e^x$
(b) $25xe^x + 25x^2 e^x$
(c) $50xe^x + 25x^2e^x$
(d) $50xe^x + 25xe^x$

10. \( \frac{d}{dt} \frac{3t+1}{\sqrt{t^2+2}} = \)
   \begin{align*}
   (a) & \frac{3(5t+2)-(3t+1)5}{(5t+2)^2} \\
   (b) & \frac{3(5t+2)-(3t+1)5}{(3t+1)^2} \\
   (c) & \frac{(3t+1)(5t+2)-(3t+1)5}{(5t+2)^2} \\
   (d) & \frac{3(5t+2)-(3t+1)(5t+2)}{(5t+2)^2} \\
   \end{align*}

11. \( \frac{d}{dt} \sqrt{\frac{t}{t^2+1}} = \)
   \begin{align*}
   (a) & \frac{\frac{1}{2}t^{-1/2}-2t}{(t^2+1)^2} \\
   (b) & \frac{\frac{1}{2}t^{-1/2}t^2-2t\sqrt{t}}{(t^2+1)^2} \\
   (c) & \frac{\frac{1}{2}t^{-1/2}(t^2+1)-2t\sqrt{t}}{(t^2+1)^2} \\
   (d) & \frac{t^{-1/2}(t^2+1)-2t\sqrt{t}}{(t^2+1)^2} \\
   \end{align*}

12. If \( f(3) = 2, \ f'(3) = 4, \ g(3) = 1, \ g'(3) = 3, \) and \( h(x) = f(x)g(x), \) then what is \( h'(3)? \)
   \begin{align*}
   (a) & 2 \\
   (b) & 10 \\
   (c) & 11 \\
   (d) & 12 \\
   (e) & 14 \\
   \end{align*}

13. If \( f(3) = 2, \ f'(3) = 4, \ g(3) = 1, \ g'(3) = 3, \) and \( h(x) = \frac{f(x)}{g(x)}, \) then what is \( h'(3)? \)
   \begin{align*}
   (a) & -2 \\
   (b) & 2 \\
   (c) & \frac{-2}{g} \\
   (d) & \frac{2}{g} \\
   (e) & 5 \\
   \end{align*}
14. If \( h = \frac{ab^2 e^b}{c^3} \) then what is \( \frac{dh}{db} \)?

(a) \( \frac{2abe^b}{c^3} \)
(b) \( \frac{2abe^b}{3c^2} \)
(c) \( \frac{2abe^b + ab^2 e^b}{c^3} \)
(d) \( \frac{2abe^b c^3 - 3c^2 ab^2 e^b}{c^6} \)

15. My old uncle Stanley has a collection of rare and valuable books: He has a total of 4,000 books, that are worth an average of $60 each. His books are rising in value over time, so that each year, the average price per book goes up by $0.50. However he also has to sell 30 books per year in order to pay for his snowboarding activities. The value of the collection is

(a) increasing by approximately $240,000 per year.
(b) increasing by approximately $2000 per year.
(c) increasing by approximately $200 per year.
(d) decreasing by approximately $1,800 per year.
(e) decreasing by approximately $119,970 per year.

16. The functions \( f(x) \) and \( h(x) \) are plotted below. The function \( g = 2f h \). What is \( g'(2) \)?

(a) \( g'(2) = -1 \)
(b) \( g'(2) = 2 \)
(c) \( g'(2) = 4 \)
(d) \( g'(2) = 32 \)
(e) None of the above