Question 1 2013 BC Q5

If $y = \frac{1}{2}x^{4/5} - \frac{3}{x^5}$, then $\frac{dy}{dx} =$

(A) $\frac{2}{5x^{1/5}} + \frac{15}{x^6}$

(B) $\frac{2}{5x^{1/5}} + \frac{15}{x^4}$

(C) $\frac{2}{5x^{1/5}} - \frac{3}{5x^4}$

(D) $\frac{2x^{1/5}}{5} + \frac{15}{x^6}$

(E) $\frac{2x^{1/5}}{5} - \frac{3}{5x^4}$

Question 2 2013 AB Q2

If $f(x) = x^3 - x^2 + x - 1$, then $f'(2) =$

(A) 10 (B) 9 (C) 7 (D) 5 (E) 3

Question 3 2013 AB Q18

If $\ln(2x + y) = x + 1$, then $\frac{dy}{dx} =$

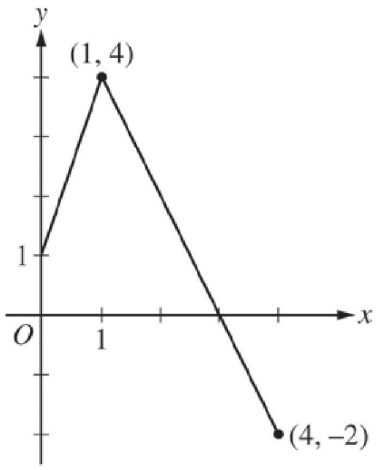
(A) -2 (B) $2x + y - 2$ (C) $2x + y$ (D) $4x + 2y - 2$ (E) $y - \frac{y}{x}$

Question 4 2013 AB Q7

Let f be the function given by $f(x) = x^3 - 6x^2 + 8x - 2$. What is the instantaneous rate of change of f at $x = 3$?

(A) -5 (B) $-\frac{15}{4}$ (C) -1 (D) 6 (E) 17

Question 5 2013 BC Q18



Graph of f

The graph of the function f, consisting of two line segments, is shown in the figure above. Let g be the function given by $g(x) = 2x + 1$, and let h be the function given by $h(x) = f(g(x))$. What is the value of $h'(1)$?

(A) -4 (B) -2 (C) 4 (D) 6 (E) nonexistent

Question 6 2013 AB Q15

$f(3)$	$g(3)$	$f'(3)$	$g'(3)$
–1	2	5	–2

The table above gives values for the functions f and g and their derivatives at $x = 3$. Let k be the function given by $k(x) = \dfrac{f(x)}{g(x)}$, where $g(x) \neq 0$. What is the value of $k'(3)$?

(A) $-\dfrac{5}{2}$ (B) -2 (C) 2 (D) 3 (E) 8

Question 7 2013 AB Q16

If $y = 5x\sqrt{x^2 + 1}$, then $\frac{dy}{dx}$ at $x = 3$ is

(A) $\frac{5}{2\sqrt{10}}$ (B) $\frac{15}{\sqrt{10}}$ (C) $\frac{15}{2\sqrt{10}} + 5\sqrt{10}$ (D) $\frac{45}{\sqrt{10}} + 5\sqrt{10}$ (E) $\frac{45}{\sqrt{10}} + 15\sqrt{10}$

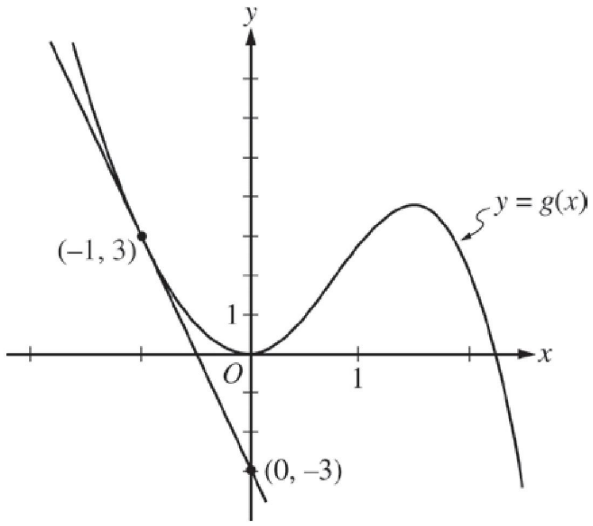
Question 8 2014 BC Q11

$$f(x) = \begin{cases} 2x + 5 & \text{for } x < -1 \\ -x^2 + 6 & \text{for } x \geq -1 \end{cases}$$

If f is the function defined above, then $f'(-1)$ is

(A) -2 (B) 2 (C) 3 (D) 5 (E) nonexistent

Question 9 2013 AB Q19



The figure above shows the graph of the function g and the line tangent to the graph of g at $x = -1$. Let h be the function given by $h(x) = e^x \cdot g(x)$. What is the value of $h'(-1)$?

(A) $\frac{9}{e}$ (B) $\frac{-3}{e}$ (C) $\frac{-6}{e}$ (D) $\frac{-6}{e} - \frac{3}{e^2}$ (E) -6

Question 10 2014 BC Q20

If $f'(x) = \dfrac{(x-2)^3\left(x^2-4\right)}{16}$ and $g(x) = f\left(x^2-1\right)$, what is $g'(2)$?

(A) 2 (B) $\frac{5}{4}$ (C) $\frac{5}{8}$ (D) $\frac{5}{16}$ (E) 0

Question 11 2014 AB Q3

If $f(x) = 4x^{-2} + \frac{1}{4}x^2 + 4$, then $f'(2) =$

(A) -62 (B) -58 (C) -3 (D) 0 (E) 1

Question 12 2015 AB Q2

If $f(x) = \sqrt{x} + \frac{3}{\sqrt{x}}$, then $f'(4) =$

(A) $\frac{1}{16}$ (B) $\frac{5}{16}$ (C) 1 (D) $\frac{7}{2}$ (E) $\frac{49}{4}$

Question 13 2014 AB Q17

If $f(x) = ae^{-ax}$ for $a > 0$, then $f'(x) =$

(A) e^{-ax}

(B) ae^{-ax}

(C) a^2e^{-ax}

(D) $-ae^{-ax}$

(E) $-a^2e^{-ax}$

Question 14 2014 AB Q6

$$\frac{d}{dx}\left(\sin^3\left(x^2\right)\right) =$$

(A) $\cos^3\left(x^2\right)$

(B) $3\sin^2\left(x^2\right)$

(C) $6x\sin^2\left(x^2\right)$

(D) $3\sin^2\left(x^2\right)\cos\left(x^2\right)$

(E) $6x\sin^2\left(x^2\right)\cos\left(x^2\right)$

Question 15 2014 AB Q13

$$\frac{d}{dx}\left(\frac{x+1}{x^2+1}\right)=$$

(A) $\dfrac{x^2+2x-1}{\left(x^2+1\right)^2}$

(B) $\dfrac{-x^2-2x+1}{x^2+1}$

(C) $\dfrac{-x^2-2x+1}{\left(x^2+1\right)^2}$

(D) $\dfrac{3x^2+2x+1}{\left(x^2+1\right)^2}$

(E) $\dfrac{1}{2x}$

Question 16 2014 AB Q23

$$f(x)=\begin{cases}3x+5 & \text{when } x<-1\\ -x^2+3 & \text{when } x\geq -1\end{cases}$$

If f is the function defined above, then $f'(-1)$ is

(A) -3 (B) -2 (C) 2 (D) 3 (E) nonexistent

Question 17 2014 AB Q80

x	$f(x)$
1	2.4
3	3.6
5	5.4

The table above gives selected values of a function f. The function is twice differentiable with $f''(x) > 0$. Which of the following could be the value of $f'(3)$?

(A) 0.6 (B) 0.7 (C) 0.9 (D) 1.2 (E) 1.5

Question 18 2015 AB Q7

If $f(x) = x^2 - 4$ and g is a differentiable function of x, what is the derivative of $f(g(x))$?

(A) $2g(x)$ (B) $2g'(x)$ (C) $2xg'(x)$ (D) $2g(x)g'(x)$ (E) $2g(x) - 4$

Question 19 2015 AB Q10

If $y = \sin x \cos x$, then at $x = \frac{\pi}{3}$, $\frac{dy}{dx} =$

(A) $-\frac{1}{2}$ (B) $-\frac{1}{4}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$ (E) 1

Question 20 2015 BC Q2

If $y^2 - 2x^2y = 8$, then $\frac{dy}{dx} =$

(A) $\frac{4}{y - 2x}$ (B) $\frac{2xy}{y - x^2}$ (C) $\frac{4 + 2xy}{y - x^2}$ (D) $\frac{2xy}{y + x^2}$ (E) $\frac{2xy + x^2}{y}$

Question 21 2015 AB Q85

Let $y = f(x)$ define a twice-differentiable function and let $y = t(x)$ be the line tangent to the graph of f at $x = 2$. If $t(x) \geq f(x)$ for all real x, which of the following must be true?

(A) $f(2) \geq 0$

(B) $f'(2) \geq 0$

(C) $f'(2) \leq 0$

(D) $f''(2) \geq 0$

(E) $f''(2) \leq 0$

Question 22 2015 BC Q27

If $f(x) = \sin x + 2x + 1$ and g is the inverse function of f, what is the value of $g'(1)$?

(A) $\frac{1}{3}$ (B) 1 (C) 3 (D) $\frac{1}{2 + \cos 1}$ (E) $2 + \cos 1$

Question 23 2016 AB Q1

If $y = \cos 2x$, then $\frac{dy}{dx} =$

(A) $-2\sin 2x$ (B) $-\sin 2x$ (C) $\sin 2x$ (D) $2\sin 2x$ (E) $2\sin x$

Question 24 2016 AB Q4

If $y = \left(\frac{x}{x+1}\right)^5$, then $\frac{dy}{dx} =$

(A) $5(1+x)^4$ (B) $\frac{x^4}{(x+1)^4}$ (C) $\frac{5x^4}{(x+1)^4}$ (D) $\frac{5x^4}{(x+1)^6}$ (E) $\frac{5x^4(2x+1)}{(x+1)^6}$

Question 25 2016 AB Q6

The slope of the line tangent to the graph of $y = \ln(1-x)$ at $x = -1$ is

(A) -1 (B) $-\frac{1}{2}$ (C) $\frac{1}{2}$ (D) $\ln 2$ (E) 1

Question 26 2016 AB Q27

If $e^{xy} - y^2 = e - 4$, then at $x = \frac{1}{2}$ and $y = 2$, $\frac{dy}{dx} =$

(A) $\frac{e}{4}$ (B) $\frac{e}{2}$ (C) $\frac{4e}{8-e}$ (D) $\frac{4e}{4-e}$ (E) $\frac{8-4e}{e}$

Question 27 2016 BC Q4

If $y = \left(\frac{x}{x+1}\right)^5$, then $\frac{dy}{dx} =$

(A) $5(1+x)^4$ (B) $\frac{x^4}{(x+1)^4}$ (C) $\frac{5x^4}{(x+1)^4}$ (D) $\frac{5x^4}{(x+1)^6}$ (E) $\frac{5x^4(2x+1)}{(x+1)^6}$

Question 28 2016 BC Q6

The slope of the line tangent to the graph of $y = \ln(1-x)$ at $x = -1$ is

(A) -1 (B) $-\frac{1}{2}$ (C) $\frac{1}{2}$ (D) $\ln 2$ (E) 1

Question 29 2016 BC Q16

If $\cos(xy) = y - 1$, then the value of $\frac{dy}{dx}$ when $x = \frac{\pi}{2}$ and $y = 1$ is

(A) $\frac{-2}{2-\pi}$ (B) $\frac{-2}{2+\pi}$ (C) 0 (D) $\frac{2}{2-\pi}$ (E) $\frac{2}{2+\pi}$

Question 30 2017 BC Q1

If $f(x) = \cos^2(3x-5)$, then $f'(x) =$

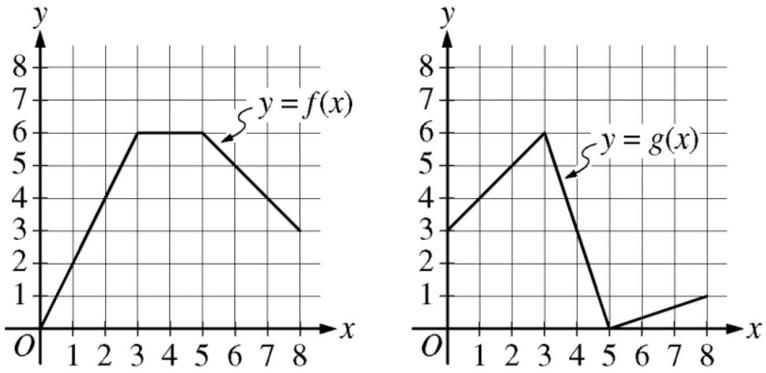
(A) $6\cos(3x-5)$

(B) $-3\sin^2(3x-5)$

(C) $-2\sin(3x-5)\cos(3x-5)$

(D) $-6\sin(3x-5)\cos(3x-5)$

Question 31 2016 BC Q78



The graphs of the piecewise linear functions f and g are shown above. If the function h is defined by $h(x) = f(x)g(x)$, then $h'(2)$ is

(A) 2 (B) 13 (C) 14 (D) 20 (E) nonexistent

Question 32 2017 BC Q9

The slope of the line tangent to the graph of $y = xe^x$ at $x = \ln 2$ is

(A) $2\ln 2$ (B) $2\ln 2 + 2$ (C) $e^2(\ln 2) + e^2$ (D) $2 + \dfrac{2\ln 2}{e}$

Question 33 2017 BC Q3

If $f(x) = \dfrac{5 - x}{x^3 + 2}$, then $f'(x) =$

(A) $\dfrac{-4x^3 + 15x^2 - 2}{\left(x^3 + 2\right)^2}$

(B) $\dfrac{-2x^3 + 15x^2 + 2}{\left(x^3 + 2\right)^2}$

(C) $\dfrac{2x^3 - 15x^2 - 2}{\left(x^3 + 2\right)^2}$

(D) $\dfrac{4x^3 - 15x^2 + 2}{\left(x^3 + 2\right)^2}$

Question 34 2017 BC Q11

If $x^2 + xy - 3y = 3$, then at the point $(2, 1)$, $\dfrac{dy}{dx} =$

(A) 5 (B) 4 (C) $\dfrac{7}{3}$ (D) 2

Question 35 2017 BC Q26

Let f be the function with $f(0) = \frac{1}{\pi^2}$, $f(2) = \frac{1}{\pi^2}$, and derivative given by $f'(x) = (x+1)\cos(\pi x)$. How many values of x in the open interval $(0, 2)$ satisfy the conclusion of the Mean Value Theorem for the function f on the closed interval $[0, 2]$?

(A) None

(B) One

(C) Two

(D) More than two

Question 36 2017 AB Q5

If $f(x) = \sin(x^2 + \pi)$, then $f'(\sqrt{2\pi}) =$

(A) $-2\sqrt{2\pi}$ (B) -2 (C) -1 (D) $\cos(2\sqrt{2\pi})$

Question 37 2017 AB Q1

If $f(x) = \left(2x^2 + 5\right)^7$, then $f'(x) =$

(A) $7(4x)^6$

(B) $7\left(2x^2 + 5\right)^6$

(C) $14x^2\left(2x^2 + 5\right)^6$

(D) $28x\left(2x^2 + 5\right)^6$

Question 38 2017 AB Q3

If $f(x) = \dfrac{5 - x}{x^3 + 2}$, then $f'(x) =$

(A) $\dfrac{-4x^3 + 15x^2 - 2}{\left(x^3 + 2\right)^2}$

(B) $\dfrac{-2x^3 + 15x^2 + 2}{\left(x^3 + 2\right)^2}$

(C) $\dfrac{2x^3 - 15x^2 - 2}{\left(x^3 + 2\right)^2}$

(D) $\dfrac{4x^3 - 15x^2 + 2}{\left(x^3 + 2\right)^2}$

Question 39 2017 AB Q8

If f is the function given by $f(x) = e^{x/3}$, which of the following is an equation of the line tangent to the graph of f at the point $(3\ln 4, 4)$?

(A) $y - 4 = \frac{4}{3}(x - 3\ln 4)$

(B) $y - 4 = 4(x - 3\ln 4)$

(C) $y - 4 = 12(x - 3\ln 4)$

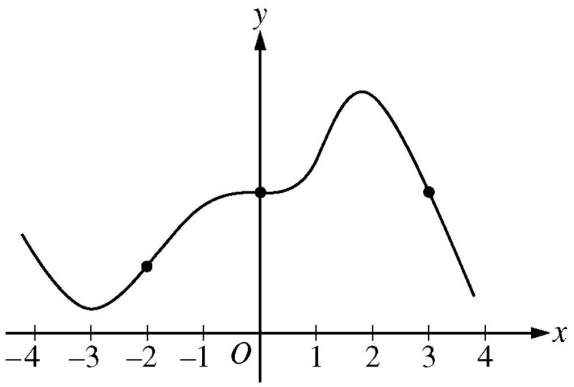
(D) $y - 3\ln 4 = 4(x - 4)$

Question 40 2017 AB Q11

If $x^2 + xy - 3y = 3$, then at the point $(2, 1)$, $\frac{dy}{dx} =$

(A) 5 (B) 4 (C) $\frac{7}{3}$ (D) 2

Question 41 2017 AB Q76



Graph of f

The graph of a differentiable function f is shown in the figure above. Which of the following is true?

(A) $f'(-2) < f'(0) < f'(3)$

(B) $f'(-2) < f'(3) < f'(0)$

(C) $f'(3) < f'(-2) < f'(0)$

(D) $f'(3) < f'(0) < f'(-2)$

Question 42 2015 BC Q90

The function f is defined by $f(x) = 3x - 4\cos(2x+1)$, and its derivative is $f'(x) = 3 + 8\sin(2x+1)$. What are all values of x that satisfy the conclusion of the Mean Value Theorem applied to f on the interval $[-1, 2]$?

(A) -0.692 and 1.263 (B) -0.479 and 1.049 (C) 0.285 (D) 0.517 (E) 1.578

Question 43 2015 AB Q12

What is the average rate of change of $y = \cos(2x)$ on the interval $\left[0, \frac{\pi}{2}\right]$?

(A) $-\frac{4}{\pi}$ (B) -1 (C) 0 (D) $\frac{\sqrt{2}}{2}$ (E) $\frac{4}{\pi}$

Question 44 2016 AB Q26

Let f be the function given by $f(x) = x^3 + 5x$. For what value of x in the closed interval $[1,3]$ does the instantaneous rate of change of f equal the average rate of change of f on that interval?

(A) $\sqrt{\frac{7}{3}}$ (B) $\sqrt{\frac{13}{3}}$ (C) $\sqrt{5}$ (D) $\sqrt{6}$ (E) $\sqrt{\frac{19}{3}}$

Question 45 2017 AB Q6

If f is the function given by $f(x) = 3x^2 - x^3$, then the average rate of change of f on the closed interval $[1, 5]$ is

(A) -21 (B) -13 (C) -12 (D) -9

Question 46 2017 AB Q85

The function g is continuous on the closed interval $[1, 4]$ with $g(1) = 5$ and $g(4) = 8$. Of the following conditions, which would guarantee that there is a number c in the open interval $(1, 4)$ where $g'(c) = 1$?

(A) g is increasing on the closed interval $[1, 4]$.

(B) g is differentiable on the open interval $(1, 4)$.

(C) g has a maximum value on the closed interval $[1, 4]$.

(D) The graph of g has at least one horizontal tangent in the open interval $(1, 4)$.