Exercises for Tangents

Using the alternative definition $\left(m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}\right)$ of the slope of the tangent to $y = f(x)$ at the point $(a, f(a))$

(1) $f(x) = (x+1)^2$ at $(2, 9)$. Solution

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(2) $f(x) = (x+2)^3$ at $(0, 8)$. Solution

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(3) $f(x) = (x+3)^4$ at $(-2, 1)$. Solution

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(4) $f(x) = \sqrt{x+1}$ at $(3, 2)$. Solution

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(5) $f(x) = \dfrac{1}{x+1}$ at $\left(3, \dfrac{1}{4}\right)$. Solution

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(6) $f(x) = \dfrac{1}{\sqrt{x+5}}$ at $(4, 3)$. Solution

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(7) $f(x) = \dfrac{x}{x+1}$ at $(-2, 2)$. Solution

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(8) $f(x) = x\sqrt{x+1}$ at $(0, 0)$. Solution

Solutions

(1)

$f(x) = (x+1)^2$ at $(2, 9)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

Back to Questions

Solutions

(1)

$f(x) = (x+1)^2$ at $(2, 9)$.

Back to Questions

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(2+h) - f(2)}{h} =$$

Solutions

(1)

$f(x) = (x+1)^2$ at $(2,9)$.

Back to Questions

$$m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h\to 0} \frac{f(2+h) - f(2)}{h} =$$

$$\lim_{h\to 0} \frac{(2+h+1)^2 - (2+1)^2}{h} =$$

Solutions

(1)

$f(x) = (x+1)^2$ at $(2, 9)$.

Back to Questions

$$m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h\to 0} \frac{f(2+h) - f(2)}{h} =$$

$$\lim_{h\to 0} \frac{(2+h+1)^2 - (2+1)^2}{h} =$$

$$\lim_{h\to 0} \frac{(3+h)^2 - (3)^2}{h} =$$

Solutions

(1)

$f(x) = (x+1)^2$ at $(2,9)$.

Back to Questions

$$m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h\to 0} \frac{f(2+h) - f(2)}{h} =$$

$$\lim_{h\to 0} \frac{(2+h+1)^2 - (2+1)^2}{h} =$$

$$\lim_{h\to 0} \frac{(3+h)^2 - (3)^2}{h} =$$

$$\lim_{h\to 0} \frac{3^2 + 2(3)h + h^2 - 3^2}{h} =$$

Solutions

(1)

$f(x) = (x+1)^2$ at $(2, 9)$.

Back to Questions

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(2+h) - f(2)}{h} =$$

$$\lim_{h \to 0} \frac{(2+h+1)^2 - (2+1)^2}{h} =$$

$$\lim_{h \to 0} \frac{(3+h)^2 - (3)^2}{h} =$$

$$\lim_{h \to 0} \frac{3^2 + 2(3)h + h^2 - 3^2}{h} =$$

$$\lim_{h \to 0} \frac{6h + h^2}{h} =$$

Solutions

(1)

$f(x) = (x+1)^2$ at $(2, 9)$.

Back to Questions

$$m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h\to 0} \frac{f(2+h) - f(2)}{h} =$$

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$$\lim_{h\to 0} \frac{3^2 + 2(3)h + h^2 - 3^2}{h} =$$

$$\lim_{h\to 0} \frac{6h + h^2}{h} =$$

$$\lim_{h\to 0} 6 + h =$$

Solutions

Back to Questions

(1)

$f(x) = (x+1)^2$ at $(2, 9)$.

$$m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h\to 0} \frac{f(2+h) - f(2)}{h} =$$

$$\lim_{h\to 0} \frac{(2+h+1)^2 - (2+1)^2}{h} =$$

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$$\lim_{h\to 0} \frac{3^2 + 2(3)h + h^2 - 3^2}{h} =$$

$$\lim_{h\to 0} \frac{6h + h^2}{h} =$$

$$\lim_{h\to 0} 6 + h =$$

6

(2) $f(x) = (x+2)^3$ at $(0, 8)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

Back to Questions

(2) $f(x) = (x+2)^3$ at $(0, 8)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(0+h) - f(0)}{h} =$$

Back to Questions

(2) $f(x) = (x+2)^3$ at $(0, 8)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(0+h) - f(0)}{h} =$$

$$\lim_{h \to 0} \frac{(0+h+2)^3 - (0+2)^3}{h} =$$

Back to Questions

(2) $f(x) = (x+2)^3$ at $(0, 8)$.

$$m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h\to 0} \frac{f(0+h) - f(0)}{h} =$$

$$\lim_{h\to 0} \frac{(0+h+2)^3 - (0+2)^3}{h} =$$

$$\lim_{h\to 0} \frac{(2+h)^3 - (2)^3}{h} =$$

Back to Questions

(2) $f(x) = (x+2)^3$ at $(0,8)$.

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$$\lim_{h \to 0} \frac{f(0+h) - f(0)}{h} =$$

$$\lim_{h \to 0} \frac{(0+h+2)^3 - (0+2)^3}{h} =$$

$$\lim_{h \to 0} \frac{(2+h)^3 - (2)^3}{h} =$$

$$\lim_{h \to 0} \frac{2^3 + 3(2)^2 h + 3(2)h^2 + h^3 - 2^3}{h} =$$

Back to Questions

(2) $f(x) = (x+2)^3$ at $(0, 8)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(0+h) - f(0)}{h} =$$

$$\lim_{h \to 0} \frac{(0+h+2)^3 - (0+2)^3}{h} =$$

$$\lim_{h \to 0} \frac{(2+h)^3 - (2)^3}{h} =$$

$$\lim_{h \to 0} \frac{2^3 + 3(2)^2 h + 3(2) h^2 + h^3 - 2^3}{h} =$$

$$\lim_{h \to 0} \frac{12h + 6h^2 + h^3}{h} =$$

Back to Questions

(2) $f(x) = (x+2)^3$ at $(0, 8)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(0+h) - f(0)}{h} =$$

$$\lim_{h \to 0} \frac{(0+h+2)^3 - (0+2)^3}{h} =$$

$$\lim_{h \to 0} \frac{(2+h)^3 - (2)^3}{h} =$$

$$\lim_{h \to 0} \frac{2^3 + 3(2)^2 h + 3(2)h^2 + h^3 - 2^3}{h} =$$

$$\lim_{h \to 0} \frac{12h + 6h^2 + h^3}{h} =$$

$$\lim_{h \to 0} 12 + 6h + h^2 =$$

Back to Questions

(2) $f(x) = (x+2)^3$ at $(0, 8)$.

Back to Questions

$$m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h\to 0} \frac{f(0+h) - f(0)}{h} =$$

$$\lim_{h\to 0} \frac{(0+h+2)^3 - (0+2)^3}{h} =$$

$$\lim_{h\to 0} \frac{(2+h)^3 - (2)^3}{h} =$$

$$\lim_{h\to 0} \frac{2^3 + 3(2)^2 h + 3(2)h^2 + h^3 - 2^3}{h} =$$

$$\lim_{h\to 0} \frac{12h + 6h^2 + h^3}{h} =$$

$$\lim_{h\to 0} 12 + 6h + h^2 =$$

12

(3) $f(x) = (x+3)^4$ at $(-2, 1)$. $m = \lim_{h \to 0} \dfrac{f(a+h) - f(a)}{h} =$

Back to Questions

(3) $f(x) = (x+3)^4$ at $(-2,1)$. $m = \lim_{h\to 0} \frac{f(a+h)-f(a)}{h} =$

$\lim_{h\to 0} \frac{f(-2+h)-f(-2)}{h} =$

Back to Questions

(3) $f(x) = (x+3)^4$ at $(-2, 1)$. $m = \lim_{h \to 0} \dfrac{f(a+h) - f(a)}{h} =$

$$\lim_{h \to 0} \frac{f(-2+h) - f(-2)}{h} =$$

$$\lim_{h \to 0} \frac{(-2+h+3)^4 - (-2+3)^4}{h} =$$

Back to Questions

(3) $f(x) = (x+3)^4$ at $(-2, 1)$. $m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$

$$\lim_{h \to 0} \frac{f(-2+h) - f(-2)}{h} =$$

$$\lim_{h \to 0} \frac{(-2+h+3)^4 - (-2+3)^4}{h} =$$

Back to Questions

$$\lim_{h \to 0} \frac{(1+h)^4 - (1)^4}{h} =$$

(3) $f(x) = (x+3)^4$ at $(-2, 1)$. $m = \lim_{h\to 0} \dfrac{f(a+h) - f(a)}{h} =$

$$\lim_{h\to 0} \frac{f(-2+h) - f(-2)}{h} =$$

$$\lim_{h\to 0} \frac{(-2+h+3)^4 - (-2+3)^4}{h} =$$

$$\lim_{h\to 0} \frac{(1+h)^4 - (1)^4}{h} =$$

$$\lim_{h\to 0} \frac{1^4 + 4(1)^3 h + 6(1)^2 h^2 + 4(1)h^3 + h^4 - 1^4}{h} =$$

Back to Questions

(3) $f(x) = (x+3)^4$ at $(-2, 1)$. $m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$

$$\lim_{h \to 0} \frac{f(-2+h) - f(-2)}{h} =$$

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$$\lim_{h \to 0} \frac{1^4 + 4(1)^3 h + 6(1)^2 h^2 + 4(1) h^3 + h^4 - 1^4}{h} =$$

$$\lim_{h \to 0} \frac{4h + 6h^2 + 4h^3 + h^4}{h} =$$

Back to Questions

(3) $f(x) = (x+3)^4$ at $(-2, 1)$. $m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$

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$$\lim_{h \to 0} \frac{1^4 + 4(1)^3 h + 6(1)^2 h^2 + 4(1) h^3 + h^4 - 1^4}{h} =$$

$$\lim_{h \to 0} \frac{4h + 6h^2 + 4h^3 + h^4}{h} =$$

$$\lim_{h \to 0} 4 + 6h + 4h^2 + h^3 =$$

Back to Questions

(3) $f(x) = (x+3)^4$ at $(-2, 1)$. $m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$

$$\lim_{h\to 0} \frac{f(-2+h) - f(-2)}{h} =$$

$$\lim_{h\to 0} \frac{(-2+h+3)^4 - (-2+3)^4}{h} =$$

Back to Questions

$$\lim_{h\to 0} \frac{(1+h)^4 - (1)^4}{h} =$$

$$\lim_{h\to 0} \frac{1^4 + 4(1)^3 h + 6(1)^2 h^2 + 4(1) h^3 + h^4 - 1^4}{h} =$$

$$\lim_{h\to 0} \frac{4h + 6h^2 + 4h^3 + h^4}{h} =$$

$$\lim_{h\to 0} 4 + 6h + 4h^2 + h^3 =$$

4

(4) $f(x) = \sqrt{x+1}$ at $(3, 2)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

Back to Questions

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Back to Questions

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$$\lim_{h \to 0} \frac{\sqrt{3+h+1} - \sqrt{3+1}}{h} =$$

Back to Questions

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$$\lim_{h \to 0} \frac{\sqrt{4+h} - \sqrt{4}}{h} =$$

Back to Questions

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$$\lim_{h \to 0} \frac{f(3+h) - f(3)}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{3+h+1} - \sqrt{3+1}}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{4+h} - \sqrt{4}}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{4+h} - 2}{h}$$

Back to Questions

(4) $f(x) = \sqrt{x+1}$ at $(3, 2)$.

$$m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h\to 0} \frac{f(3+h) - f(3)}{h} =$$

$$\lim_{h\to 0} \frac{\sqrt{3+h+1} - \sqrt{3+1}}{h} =$$

$$\lim_{h\to 0} \frac{\sqrt{4+h} - \sqrt{4}}{h} =$$

$$\lim_{h\to 0} \frac{\sqrt{4+h} - 2}{h} \frac{\sqrt{4+h} + 2}{\sqrt{4+h} + 2} =$$

Back to Questions

(4) $f(x) = \sqrt{x+1}$ at $(3, 2)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(3+h) - f(3)}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{3+h+1} - \sqrt{3+1}}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{4+h} - \sqrt{4}}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{4+h} - 2}{h} \frac{\sqrt{4+h} + 2}{\sqrt{4+h} + 2} =$$

$$\lim_{h \to 0} \frac{\left(\sqrt{4+h}\right)^2 - 2^2}{h\left(\sqrt{4+h} + 2\right)} =$$

Back to Questions

(4) $f(x) = \sqrt{x+1}$ at $(3, 2)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(3+h) - f(3)}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{3+h+1} - \sqrt{3+1}}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{4+h} - \sqrt{4}}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{4+h} - 2}{h} \frac{\sqrt{4+h} + 2}{\sqrt{4+h} + 2} =$$

$$\lim_{h \to 0} \frac{\left(\sqrt{4+h}\right)^2 - 2^2}{h\left(\sqrt{4+h} + 2\right)} =$$

$$\lim_{h \to 0} \frac{4+h-4}{h\left(\sqrt{4+h} + 2\right)} =$$

Back to Questions

(4) $f(x) = \sqrt{x+1}$ at $(3, 2)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(3+h) - f(3)}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{3+h+1} - \sqrt{3+1}}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{4+h} - \sqrt{4}}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{4+h} - 2}{h} \frac{\sqrt{4+h} + 2}{\sqrt{4+h} + 2} =$$

$$\lim_{h \to 0} \frac{\left(\sqrt{4+h}\right)^2 - 2^2}{h\left(\sqrt{4+h} + 2\right)} =$$

$$\lim_{h \to 0} \frac{4+h-4}{h\left(\sqrt{4+h} + 2\right)} =$$

$$\lim_{h \to 0} \frac{h}{h\left(\sqrt{4+h} + 2\right)} =$$

Back to Questions

(4) $f(x) = \sqrt{x+1}$ at $(3, 2)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(3+h) - f(3)}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{3+h+1} - \sqrt{3+1}}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{4+h} - \sqrt{4}}{h} =$$

$$\lim_{h \to 0} \frac{\sqrt{4+h} - 2}{h} \frac{\sqrt{4+h} + 2}{\sqrt{4+h} + 2} =$$

$$\lim_{h \to 0} \frac{\left(\sqrt{4+h}\right)^2 - 2^2}{h\left(\sqrt{4+h} + 2\right)} =$$

$$\lim_{h \to 0} \frac{4+h-4}{h\left(\sqrt{4+h} + 2\right)} =$$

$$\lim_{h \to 0} \frac{h}{h\left(\sqrt{4+h} + 2\right)} =$$

$$\lim_{h \to 0} \frac{1}{\sqrt{4+h} + 2} =$$

Back to Questions

(4) $f(x) = \sqrt{x+1}$ at $(3, 2)$.

$$m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h\to 0} \frac{f(3+h) - f(3)}{h} =$$

$$\lim_{h\to 0} \frac{\sqrt{3+h+1} - \sqrt{3+1}}{h} =$$

$$\lim_{h\to 0} \frac{\sqrt{4+h} - \sqrt{4}}{h} =$$

$$\lim_{h\to 0} \frac{\sqrt{4+h} - 2}{h} \frac{\sqrt{4+h} + 2}{\sqrt{4+h} + 2} =$$

$$\lim_{h\to 0} \frac{\left(\sqrt{4+h}\right)^2 - 2^2}{h\left(\sqrt{4+h} + 2\right)} =$$

$$\lim_{h\to 0} \frac{4+h-4}{h\left(\sqrt{4+h} + 2\right)} =$$

$$\lim_{h\to 0} \frac{h}{h\left(\sqrt{4+h} + 2\right)} =$$

$$\lim_{h\to 0} \frac{1}{\sqrt{4+h} + 2} =$$

$$\frac{1}{4}$$

Back to Questions

(5) $f(x) = \frac{1}{x+1}$ at $\left(3, \frac{1}{4}\right)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

Back to Questions

(5) $f(x) = \dfrac{1}{x+1}$ at $\left(3, \dfrac{1}{4}\right)$.

$$m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h\to 0} \frac{f(3+h) - f(3)}{h} =$$

Back to Questions

(5) $f(x) = \dfrac{1}{x+1}$ at $\left(3, \dfrac{1}{4}\right)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(3+h) - f(3)}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{1}{3+h+1} - \dfrac{1}{3+1}}{h} =$$

Back to Questions

(5) $f(x) = \frac{1}{x+1}$ at $\left(3, \frac{1}{4}\right)$.

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$$\lim_{h \to 0} \frac{\frac{1}{3+h+1} - \frac{1}{3+1}}{h} =$$

$$\lim_{h \to 0} \frac{\frac{1}{4+h} - \frac{1}{4}}{h} =$$

Back to Questions

(5) $f(x) = \dfrac{1}{x+1}$ at $\left(3, \dfrac{1}{4}\right)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(3+h) - f(3)}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{1}{3+h+1} - \dfrac{1}{3+1}}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{1}{4+h} - \dfrac{1}{4}}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{4-(4+h)}{(4+h)4}}{h} =$$

Back to Questions

(5) $f(x) = \dfrac{1}{x+1}$ at $\left(3, \dfrac{1}{4}\right)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(3+h) - f(3)}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{1}{3+h+1} - \dfrac{1}{3+1}}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{1}{4+h} - \dfrac{1}{4}}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{4-(4+h)}{(4+h)4}}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{-h}{(4+h)4}}{h} =$$

Back to Questions

(5) $f(x) = \dfrac{1}{x+1}$ at $\left(3, \dfrac{1}{4}\right)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(3+h) - f(3)}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{1}{3+h+1} - \dfrac{1}{3+1}}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{1}{4+h} - \dfrac{1}{4}}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{4-(4+h)}{(4+h)4}}{h} =$$

$$\lim_{h \to 0} \frac{\dfrac{-h}{(4+h)4}}{h} =$$

$$\lim_{h \to 0} \frac{-1}{(4+h)4} =$$

$$\frac{-1}{(4+0)4} =$$

Back to Questions

(5) $f(x) = \dfrac{1}{x+1}$ at $\left(3, \dfrac{1}{4}\right)$.

$$m = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h\to 0} \frac{f(3+h) - f(3)}{h} =$$

Back to Questions

$$\lim_{h\to 0} \frac{\dfrac{1}{3+h+1} - \dfrac{1}{3+1}}{h} =$$

$$\lim_{h\to 0} \frac{\dfrac{1}{4+h} - \dfrac{1}{4}}{h} =$$

$$\lim_{h\to 0} \frac{\dfrac{4-(4+h)}{(4+h)4}}{h} =$$

$$\lim_{h\to 0} \frac{\dfrac{-h}{(4+h)4}}{h} =$$

$$\lim_{h\to 0} \frac{-1}{(4+h)4} =$$

$$\frac{-1}{(4+0)4} =$$

$$-\frac{1}{16}$$

(6) $f(x) = \dfrac{1}{\sqrt{x+5}}$ at $(4, 3)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

Back to Questions

(6) $f(x) = \dfrac{1}{\sqrt{x+5}}$ at $(4, 3)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(4+h) - f(4)}{h} =$$

Back to Questions

(6) $f(x) = \frac{1}{\sqrt{x+5}}$ at $(4, 3)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

$$\lim_{h \to 0} \frac{f(4+h) - f(4)}{h} =$$

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Back to Questions

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$$\lim_{h \to 0} \frac{\dfrac{1}{\sqrt{9+h}} - \dfrac{1}{3}}{h}$$

Back to Questions

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$$\lim_{h \to 0} \frac{\frac{1}{\sqrt{9+h}} - \frac{1}{3}}{h} \left(\frac{\frac{1}{\sqrt{9+h}} + \frac{1}{3}}{\frac{1}{\sqrt{9+h}} + \frac{1}{3}} \right) =$$

Back to Questions

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Back to Questions

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Back to Questions

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Back to Questions

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

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$$\lim_{h \to 0} \frac{\dfrac{9 - (9+h)}{(9+h)9}}{h\left(\dfrac{1}{\sqrt{9+h}} + \dfrac{1}{3}\right)} =$$

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Back to Questions

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$$\lim_{h\to 0} \frac{\dfrac{9-(9+h)}{(9+h)9}}{h\left(\dfrac{1}{\sqrt{9+h}} + \dfrac{1}{3}\right)} = \lim_{h\to 0} \frac{\dfrac{-h}{(9+h)9}}{h\left(\dfrac{1}{\sqrt{9+h}} + \dfrac{1}{3}\right)} =$$

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Back to Questions

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$$\lim_{h \to 0} \frac{\dfrac{9-(9+h)}{(9+h)9}}{h\left(\dfrac{1}{\sqrt{9+h}} + \dfrac{1}{3}\right)} = \lim_{h \to 0} \frac{\dfrac{-h}{(9+h)9}}{h\left(\dfrac{1}{\sqrt{9+h}} + \dfrac{1}{3}\right)} = \lim_{h \to 0} \frac{\dfrac{-1}{(9+h)9}}{\dfrac{1}{\sqrt{9+h}} + \dfrac{1}{3}} =$$

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Back to Questions

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$$\lim_{h\to 0} \frac{\dfrac{9-(9+h)}{(9+h)9}}{h\left(\dfrac{1}{\sqrt{9+h}} + \dfrac{1}{3}\right)} = \lim_{h\to 0} \frac{\dfrac{-h}{(9+h)9}}{h\left(\dfrac{1}{\sqrt{9+h}} + \dfrac{1}{3}\right)} = \lim_{h\to 0} \frac{\dfrac{-1}{(9+h)9}}{\dfrac{1}{\sqrt{9+h}} + \dfrac{1}{3}} =$$

$$\frac{\dfrac{-1}{(9+0)9}}{\dfrac{1}{\sqrt{9+0}} + \dfrac{1}{3}} =$$

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Back to Questions

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$$\frac{\dfrac{-1}{(9+0)9}}{\dfrac{1}{\sqrt{9+0}} + \dfrac{1}{3}} = \frac{\dfrac{-1}{(9)9}}{\dfrac{1}{\sqrt{9}} + \dfrac{1}{3}} =$$

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$$\lim_{h \to 0} \frac{\frac{9-(9+h)}{(9+h)9}}{h\left(\frac{1}{\sqrt{9+h}} + \frac{1}{3}\right)} = \lim_{h \to 0} \frac{\frac{-h}{(9+h)9}}{h\left(\frac{1}{\sqrt{9+h}} + \frac{1}{3}\right)} = \lim_{h \to 0} \frac{\frac{-1}{(9+h)9}}{\frac{1}{\sqrt{9+h}} + \frac{1}{3}} =$$

$$\frac{\frac{-1}{(9+0)9}}{\frac{1}{\sqrt{9+0}} + \frac{1}{3}} = \frac{\frac{-1}{(9)9}}{\frac{1}{\sqrt{9}} + \frac{1}{3}} = \frac{\frac{-1}{81}}{\frac{1}{3} + \frac{1}{3}} =$$

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Back to Questions

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$$\frac{\dfrac{-1}{(9+0)9}}{\dfrac{1}{\sqrt{9+0}} + \dfrac{1}{3}} = \frac{\dfrac{-1}{(9)9}}{\dfrac{1}{\sqrt{9}} + \dfrac{1}{3}} = \frac{\dfrac{-1}{81}}{\dfrac{1}{3} + \dfrac{1}{3}} = \frac{\dfrac{-1}{81}}{\dfrac{2}{3}} =$$

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$$\frac{\dfrac{-1}{(9+0)9}}{\dfrac{1}{\sqrt{9+0}} + \dfrac{1}{3}} = \frac{\dfrac{-1}{(9)9}}{\dfrac{1}{\sqrt{9}} + \dfrac{1}{3}} = \frac{\dfrac{-1}{81}}{\dfrac{1}{3} + \dfrac{1}{3}} = \frac{\dfrac{-1}{81}}{\dfrac{2}{3}} = \frac{3}{2}\,\frac{-1}{81} =$$

Back to Questions

(6) $f(x) = \dfrac{1}{\sqrt{x+5}}$ at $(4,3)$.

Back to Questions

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$$\lim_{h\to 0}\frac{\frac{1}{\sqrt{4+h+5}}-\frac{1}{\sqrt{4+5}}}{h} =$$

$$\lim_{h\to 0}\frac{\frac{1}{\sqrt{9+h}}-\frac{1}{\sqrt{9}}}{h} =$$

$$\lim_{h\to 0}\frac{\frac{1}{\sqrt{9+h}}-\frac{1}{3}}{h}\left(\frac{\frac{1}{\sqrt{9+h}}+\frac{1}{3}}{\frac{1}{\sqrt{9+h}}+\frac{1}{3}}\right) = \lim_{h\to 0}\frac{\left(\frac{1}{\sqrt{9+h}}\right)^2-\left(\frac{1}{3}\right)^2}{h\left(\frac{1}{\sqrt{9+h}}+\frac{1}{3}\right)} = \lim_{h\to 0}\frac{\frac{1}{9+h}-\frac{1}{9}}{h\left(\frac{1}{\sqrt{9+h}}+\frac{1}{3}\right)} =$$

$$\lim_{h\to 0}\frac{\frac{9-(9+h)}{(9+h)9}}{h\left(\frac{1}{\sqrt{9+h}}+\frac{1}{3}\right)} = \lim_{h\to 0}\frac{\frac{-h}{(9+h)9}}{h\left(\frac{1}{\sqrt{9+h}}+\frac{1}{3}\right)} = \lim_{h\to 0}\frac{\frac{-1}{(9+h)9}}{\frac{1}{\sqrt{9+h}}+\frac{1}{3}} =$$

$$\frac{\frac{-1}{(9+0)9}}{\frac{1}{\sqrt{9+0}}+\frac{1}{3}} = \frac{\frac{-1}{(9)9}}{\frac{1}{\sqrt{9}}+\frac{1}{3}} = \frac{\frac{-1}{81}}{\frac{1}{3}+\frac{1}{3}} = \frac{\frac{-1}{81}}{\frac{2}{3}} = \frac{3}{2}\,\frac{-1}{81} = -\frac{1}{54}$$

(7) $f(x) = \dfrac{x}{x+1}$ at $(-2, 2)$.

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} =$$

Back to Questions

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Back to Questions

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$$\lim_{h \to 0} \frac{f(-2+h) - f(-2)}{h} = \lim_{h \to 0} \frac{\dfrac{-2+h}{-2+h+1} - \dfrac{-2}{-2+1}}{h} =$$

Back to Questions

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Back to Questions

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Back to Questions

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Back to Questions

$$\lim_{h\to 0} \frac{\dfrac{-2+h}{-1+h} - 2\dfrac{-1+h}{-1+h}}{h} =$$

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Back to Questions

$$\lim_{h\to 0} \frac{\dfrac{-2+h}{-1+h} - 2\dfrac{-1+h}{-1+h}}{h} = \lim_{h\to 0} \frac{-2+h-2(-1+h)}{h(-1+h)} =$$

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Back to Questions

$$\lim_{h\to 0} \frac{\dfrac{-2+h}{-1+h} - 2\dfrac{-1+h}{-1+h}}{h} = \lim_{h\to 0} \frac{-2+h-2(-1+h)}{h(-1+h)} = \lim_{h\to 0} \frac{-2+h+2-2h}{h(-1+h)} =$$

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$$\lim_{h\to 0} \frac{f(-2+h) - f(-2)}{h} = \lim_{h\to 0} \frac{\dfrac{-2+h}{-2+h+1} - \dfrac{-2}{-2+1}}{h} = \lim_{h\to 0} \frac{\dfrac{-2+h}{-1+h} - \dfrac{-2}{-1}}{h} = \lim_{h\to 0} \frac{\dfrac{-2+h}{-1+h} - 2}{h} =$$

Back to Questions

$$\lim_{h\to 0} \frac{\dfrac{-2+h}{-1+h} - 2\dfrac{-1+h}{-1+h}}{h} = \lim_{h\to 0} \frac{-2+h-2(-1+h)}{h(-1+h)} = \lim_{h\to 0} \frac{-2+h+2-2h}{h(-1+h)} = \lim_{h\to 0} \frac{-h}{h(-1+h)} =$$

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$$\lim_{h\to 0} \frac{f(-2+h) - f(-2)}{h} = \lim_{h\to 0} \frac{\dfrac{-2+h}{-2+h+1} - \dfrac{-2}{-2+1}}{h} = \lim_{h\to 0} \frac{\dfrac{-2+h}{-1+h} - \dfrac{-2}{-1}}{h} = \lim_{h\to 0} \frac{\dfrac{-2+h}{-1+h} - 2}{h} =$$

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$$\lim_{h\to 0} \frac{\dfrac{-2+h}{-1+h} - 2\dfrac{-1+h}{-1+h}}{h} = \lim_{h\to 0} \frac{-2+h-2(-1+h)}{h(-1+h)} = \lim_{h\to 0} \frac{-2+h+2-2h}{h(-1+h)} = \lim_{h\to 0} \frac{-h}{h(-1+h)} = \lim_{h\to 0} \frac{-1}{-1+h} =$$

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$$\frac{-1}{-1+0} = 1$$

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