

Watch. Practice. Understand. | Lesson 265

Calculus Chapter 2 Review with Sample Test Questions and Analysis

Watch the matching video: https://www.youtube.com/watch?v=E_Kfny6BrXw

Practice focus: Limits and one-sided limits

Related course review; confirm topics with your teacher.

Name: _____ Date: _____ Show your reasoning and check units.

01 Find $\lim_{x \rightarrow 3} \frac{(x^2 - 9)}{(x - 3)}$.

02 Find $\lim_{x \rightarrow 0} \sin x / x$, using radians.

03 Find the left and right limits of $|x|/x$ at 0. Does the two-sided limit exist?

04 If $f(x)=x+2$ for $x<1$ and $f(x)=4-x$ for $x\geq 1$, find $\lim_{x \rightarrow 1} f(x)$.

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Practice focus: Continuity

Related course review; confirm topics with your teacher.

Name: _____ Date: _____ Show your reasoning and check units.

05 Choose k to make $f(x) = (x^2 - 4)/(x - 2)$ for $x \neq 2$ and $f(2) = k$ continuous at 2.

06 Classify the discontinuity of $f(x) = 1/(x - 3)$ at 3.

07 State the three requirements for continuity at $x = a$.

08 Use continuity to show $x^3 + x - 1$ has a zero in $(0, 1)$.

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Calculus Chapter 2 Review with Sample Test Questions and Analysis

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Practice focus: Derivative definition and basic rules

Related course review; confirm topics with your teacher.

Name: _____ Date: _____ Show your reasoning and check units.

09 Use the limit definition to differentiate $f(x)=x^2+3x$.

10 Differentiate $f(x)=4x^5 - 3x^2 + 7$.

11 Find the tangent line to $y=x^2$ at $x=2$.

12 Where is $f(x)=|x|$ not differentiable, and why?

Worked answers | Lesson 265

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01 Find $\lim$ as $x \rightarrow 3$ of $(x^2 - 9)/(x - 3)$.

Cancel $x - 3$ for $x \neq 3$ to obtain $x + 3$. Limit: 6.

02 Find $\lim$ as $x \rightarrow 0$ of $\sin x / x$, using radians.

The fundamental trigonometric limit is 1.

03 Find the left and right limits of $|x|/x$ at 0. Does the two-sided limit exist?

For $x < 0$, value -1; for $x > 0$, value 1. Unequal one-sided limits mean the two-sided limit does not exist.

04 If $f(x) = x + 2$ for $x < 1$ and $f(x) = 4 - x$ for $x \geq 1$, find $\lim$ as $x \rightarrow 1$ of $f(x)$.

Left limit 3 and right limit 3 agree, so the limit is 3.

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Practice focus: Continuity

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05 Choose k to make $f(x)=(x^2-4)/(x-2)$ for $x \neq 2$ and $f(2)=k$ continuous at 2.

The limit is $\lim_{x \rightarrow 2} (x+2)=4$. Set $k=4$.

06 Classify the discontinuity of $f(x)=1/(x-3)$ at 3.

Infinite discontinuity: the denominator tends to 0 while numerator remains 1; $x=3$ is a vertical asymptote.

07 State the three requirements for continuity at $x=a$.

$f(a)$ is defined; $\lim_{x \rightarrow a} f(x)$ exists; that limit equals $f(a)$.

08 Use continuity to show $x^3 + x - 1$ has a zero in $(0,1)$.

It is a continuous polynomial; $f(0)=-1$ and $f(1)=1$. The intermediate value theorem guarantees a zero.

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09 Use the limit definition to differentiate $f(x)=x^2+3x$.

$$[f(x+h)-f(x)]/h = 2x+h+3. \text{ Let } h \rightarrow 0: f'(x)=2x+3.$$

10 Differentiate $f(x)=4x^5 - 3x^2 + 7$.

$$\text{Power rule term by term: } f'(x)=20x^4 - 6x.$$

11 Find the tangent line to $y=x^2$ at $x=2$.

$$\text{Point } (2,4), \text{ slope } 2x=4. \text{ Tangent: } y-4=4(x-2), \text{ or } y=4x-4.$$

12 Where is $f(x)=|x|$ not differentiable, and why?

At $x=0$; the left slope is -1 and the right slope is 1, so the derivative limit fails.