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← -MAT 125 Calculus A - Fall 2026 (all sections), Fall 2026

HW9: linear approximation, and some review (Homework)

INSTRUCTOR

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Due Date: WED, NOV 4, 2026 6:00 PM EST

Current Score: – / 17 POINTS | 0.0 %

REQUEST EXTENSION

Scoring and Assignment Information

QUESTION	1	2	3	4	5	6	7	8	9
POINTS	– / 1	– / 1	– / 1	– / 1	– / 1	– / 1	– / 1	– / 1	– / 1

Assignment Submission

For this assignment, you submit answers by question parts. The number of submissions remaining for each question part only changes if you submit or change the answer.

Assignment Scoring

Your last submission is used for your score.

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1. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.9.001.MI.

Find the linearization $L(x)$ of the function at a.

$$f(x) = x^3 - x^2 + 9, \quad a = -3$$

$L(x) =$ [ ]

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2. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.9.006.MI.

Find the linear approximation $L(x)$ of the function $g(x) = \sqrt[5]{1 + x}$ at $a = 0$.

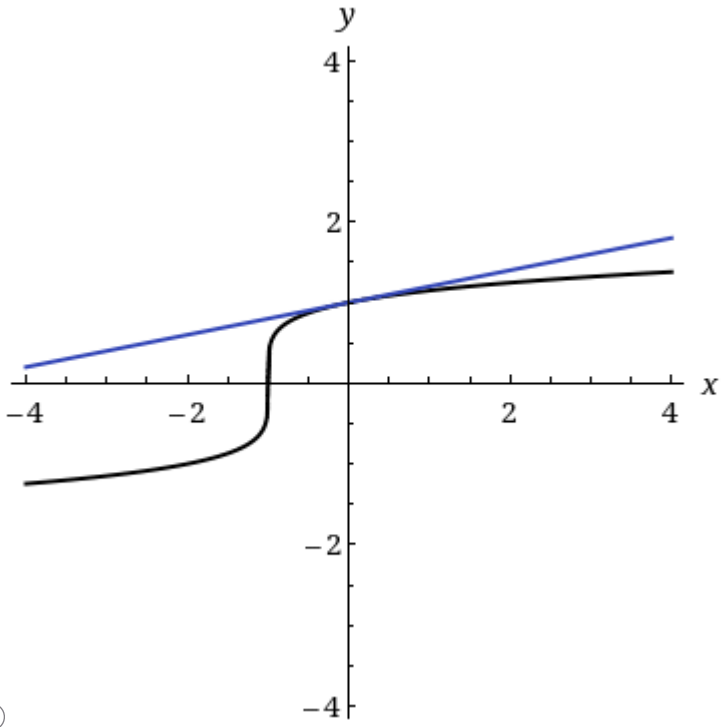
$L(x) \approx$ [ ]

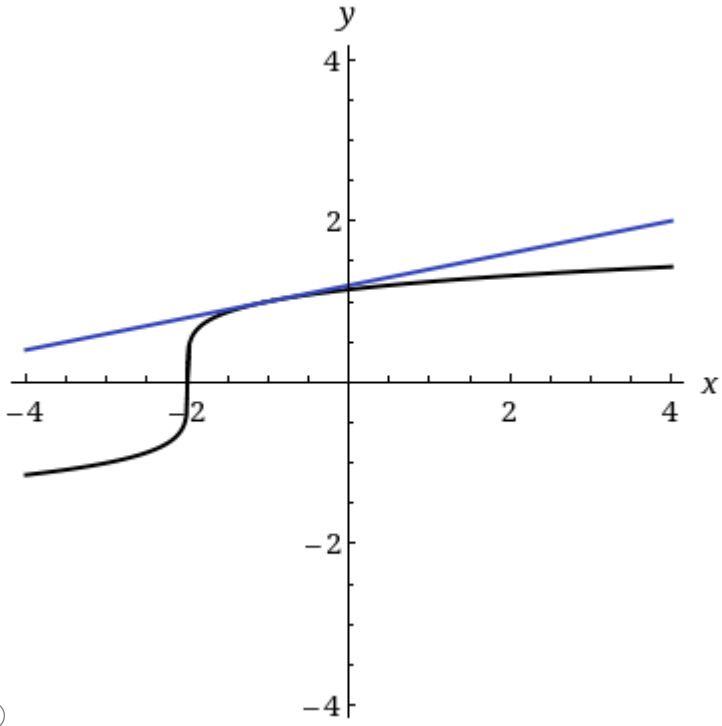
Use it to approximate the numbers $\sqrt[5]{0.95}$ and $\sqrt[5]{1.1}$. (Round your answers to three decimal places.)

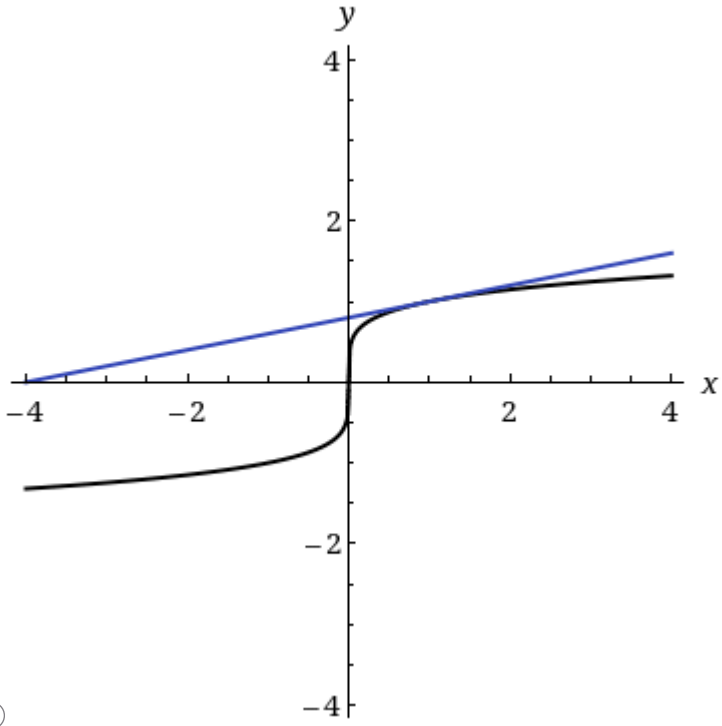
$\sqrt[5]{0.95} \approx$ [ ]

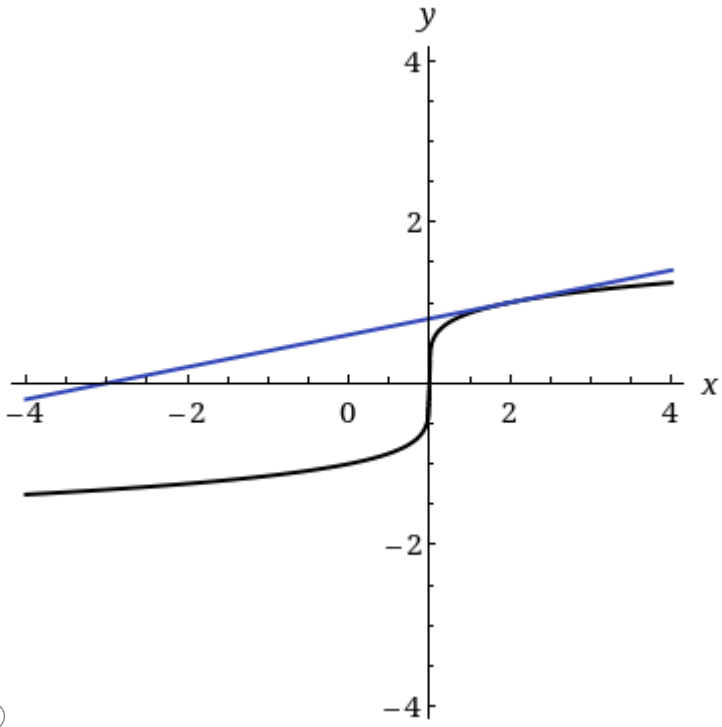
$\sqrt[5]{1.1} \approx$ [ ]

Use technology to graph g and the tangent line in the same viewing window.






y
4
2
x
−4
−2
2
4
−2
−4


y
4
2
x
−4
−2
0
2
4
−2
−4

3. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.9.012.

Find the differential dy of the following function.

$$y = (1 + r^4)^{-2}$$

$dy =$ [ ]

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4. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.9.015.

Use a linear approximation (or differentials) to estimate the given number.

$$(1.999)^5$$

[ ]

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5. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.9.019.MI.

Use a linear approximation (or differentials) to estimate the given number.

$$e^{0.01}$$

[ ]

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6. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.9.033.

The circumference of a sphere was measured to be 78 cm with a possible error of 0.5 cm.

(a) Use differentials to estimate the maximum error (in cm^2) in the calculated surface area. (Round your answer to the nearest integer.)

[ ] cm^2

What is the relative error? (Round your answer to three decimal places.)

[ ]

(b) Use differentials to estimate the maximum error (in cm^3) in the calculated volume. (Round your answer to the nearest integer.)

[ ] cm^3

What is the relative error? (Round your answer to three decimal places.)

[ ]

7. **[– / 1 Points]**

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.9.037.

When blood flows along a blood vessel, the flux F (the volume of blood per unit time that flows past a given point) is proportional to the fourth power of the radius R of the blood vessel.

$$F = kR^4$$

(This is known as Poiseuille's Law; we will show why it is true in a future chapter.) A partially clogged artery can be expanded by an operation called angioplasty, in which a balloon-tipped catheter is inflated inside the artery in order to widen it and restore the normal blood flow.

Show that the relative change in F is about four times the relative change in R.

$$F = kR^4 \quad \Rightarrow \quad \frac{dF}{dR} = \square$$

$$\Rightarrow \quad dF = \left(\square \right) dR$$

$$\Rightarrow \quad \frac{dF}{F} = \frac{\left(\square \right) dR}{kR^4}$$

$$= 4\left(\frac{dR}{R}\right)$$

How will a 7% increase in the radius affect the flow of blood?

A 7% increase in the radius corresponds to a(n) [ ] % increase in blood flow.

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8. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.R.086.

What is the slope of the line that passes through the point (7, 0) and is tangent to the graph of $f(x) = e^{-x}$?

- ○ 6
- ○ −6
- ○ $\frac{1}{e^6}$
- ○ $-\frac{1}{e^6}$

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9. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.R.094.

A particle moves along the curve given by $y = x \ln(x)$ so that y increases at

A particle moves along the curve given by $y = x\ln(x)$ so that y increases at a rate of 12 units per second. How fast is x increasing when the particle is at the point $(e^2, 2e^2)$?

- ◯ 4
- ◯ 6
- ◯ 8
- ◯ 10

---

10. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.R.100.

The volume of a right circular cone is $V = \frac{1}{3}\pi r^2 h$, where r is the radius of the base and h is the height.

(a) Find the rate of change of the volume with respect to the height if the radius is constant.

$\frac{dV}{dh} =$ [ ]

(b) Find the rate of change of the volume with respect to the radius if the height is constant.

$\frac{dV}{dr} =$ [ ]

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11. [– / 1 Points]

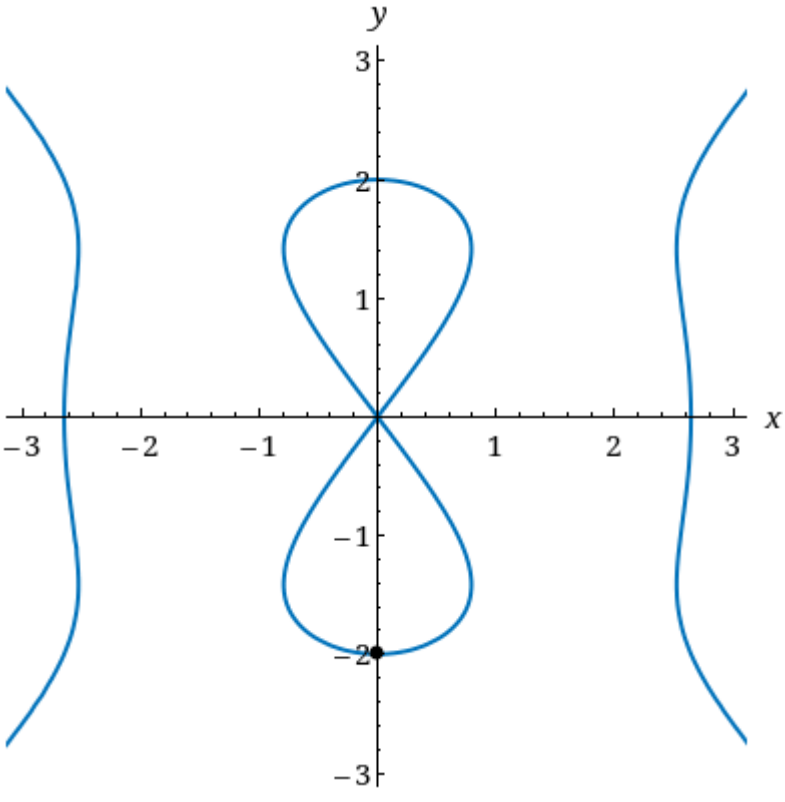
DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.5.038.

Use implicit differentiation to find an equation of the tangent line to the curve at the given point.

$y^2(y^2 - 4) = x^2(x^2 - 7)$ $(0, -2)$ (devil's curve)

$y^2(y^2 - 4) = x^2(x^2 - 7)$, $(0, -2)$ (devil's curve)



12. **[– / 1 Points]**

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.7.004.MI.

Differentiate the function.

$$f(x) = \sin(9 \ln(x))$$

$f'(x) =$

13. **[– / 1 Points]**

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.7.515.XP.

Use logarithmic differentiation to find the derivative of the function.

$$y = \frac{(\sin(x))^6 (\tan(x))^2}{(x^2+3)^2}$$

y' =

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14. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.4.061.

At what point on the curve $y = \sqrt{-3 + 2x}$ is the tangent line perpendicular to the line $12x + 4y = 1$?

(x, y) = ( )

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15. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.6.023.

Find the derivative of the function.

$$y = 5 \tan^{-1}\left(x - \sqrt{1 + x^2}\right)$$

y' =

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16. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.8.020.

Newton's Law of Gravitation says that the magnitude F of the force exerted by a body of mass m on a body of mass M is

$$F = \frac{GmM}{r^2},$$

where G is the gravitational constant and r is the distance between the bodies.

(a) Find $\frac{dF}{dr}$.

$\frac{dF}{dr} =$ [ ]

What is the meaning of $\frac{dF}{dr}$ in the context of this problem?

- ○ $\frac{dF}{dr}$ represents the rate of change of the mass with respect to the force.
- ○ $\frac{dF}{dr}$ represents the rate of change of the distance between the bodies with respect to the force.
- ○ $\frac{dF}{dr}$ represents the amount of force per distance.
- ○ $\frac{dF}{dr}$ represents the rate of change of the force with respect to the distance between the bodies.
- ○ $\frac{dF}{dr}$ represents the rate of change of the mass with respect to the distance between the bodies.

What does the minus sign in the expression indicate?

- ○ The minus sign indicates that as the distance between the bodies increases, the magnitude of the force increases.
- ○ The minus sign indicates that the force between the bodies is decreasing.
- ○ The minus sign indicates that as the distance between the bodies decreases, the magnitude of the force remains constant.
- ○ The minus sign indicates that as the distance between the bodies

increases, the magnitude of the force decreases.

◯ The minus sign indicates that the bodies are being forced in the negative direction.

(b) Suppose it is known that the earth attracts an object with a force that decreases at the rate of 4 N/km when r = 30,000 km. How fast does this force change when r = 15,000 km?

[ ] N/km

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17. [– / 1 Points]

DETAILS | MY NOTES | ASK YOUR TEACHER

SCalcCC5 3.8.026.

The number of yeast cells in a laboratory culture increases rapidly initially but levels off eventually. The population is modeled by the function

$$n = f(t) = \frac{a}{1 + be^{-0.4t}}$$

where t is measured in hours. At time t = 0 the population is 30 cells and is increasing at a rate of 9 cells/hour. Find the values of a and b.

a = [ ]

b = [ ]

According to this model, what happens to the yeast population in the long run, that is, as $t \to \infty$?

◯ The yeast population will stabilize at 3 cells.

◯ The yeast population will stabilize at 60 cells.

◯ The yeast population will shrink to 0 cells.

◯ The yeast population will stabilize at 120 cells.

◯ The yeast population will grow without bound.

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