THE UNIVERSITY OF NEW MEXICO

Calculus 3 (2531) Prep

UNM ENGINEERING STUDENT SUCCESS CENTER

@UNMESSCENTER

Drop-In Tutoring for Engineering & Computing

Get help in your core STEM courses, engineering & computing specific classes, software, and coding languages.

ESS suite (CEC 2080) & online via the Penji App (with Zoom)

Tutoring schedule & more info at

ess.unm.edu/services/tutoring/

or through our app - succESS

CENTER FOR ACADEMIC PROGRAM SUPPORT

caps.unm.edu

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/unmcaps

WRITING

SCIENCE

MATH

LANGUAGES

Online Drop-in Support

Individual Appointments

Supplemental Instruction

Learning Strategies

Semester-Long Engagement Opportunities

Many are open to pre- and full majors and have no citizenship or GPA requirements.

https://goto.unm.edu/mentoring

MENTORING

- **BE a mentor**
  ...to our incoming students in their transition into the University of New Mexico, the university setting, and Albuquerque.
- **HAVE a mentor***
  ...who is a STEM Professional working in the field to build your network and receive guidance and support.

**This program is open to UNM STEM Majors. Priority is given to Freshmen and Sophomores, but all levels are encouraged to apply.*

https://goto.unm.edu/internships

INTERNSHIPS

Getting real-world experiences leads to your satisfaction with your undergraduate journey. Gain valuable hands-on experience while making professional connections.

These programs are only open to School of Engineering Students.

https://goto.unm.edu/research

RESEARCH

- **EPICS @UNM**
  ...to give back to the community, earn credit, and gain research experience all at the same time!
- **Student Research Experience Program**
  ...to get hands-on research experience to understand how your courses fit in to real-world applications.

These programs are only open to School of Engineering Students.

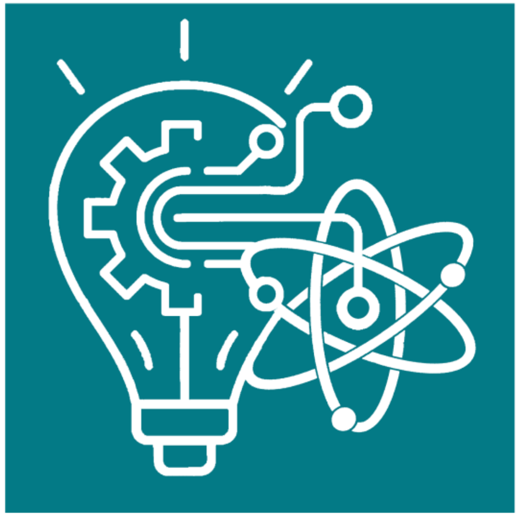
ENGINEERING STUDENT SUCCESS CENTER

For more information, or to apply, visit:
https://ess.unm.edu/programs/current-students

ENGINEERING STUDENT SUCCESS CENTER

A tool for engineering your

succESS



This web **APP** allows you to keep up to date on all we have to offer.

Put your learning into your own hands.

success.unm.edu

Includes 1-click RSVP

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ENGINEERING STUDENT SUCCESS CENTER

You are WELCOME to ALL events

Spring 2023 Events

We are Student Success

Pre-Semester Prep Series
Physics 1, Chem 1, Trig/Pre-Calc through Calc 3

Semester Long Programs
Mentoring, Internships, Research

Presentation Prep Series
What is a Conference?
Designing Effective Presentations
Data Visualization
Delivering Presentations

1st & 2nd Year Student Events
Building Community - Weekly focused Study Groups
How to make the most of your learning
Twitch streaming event
Study Skills
Manage Your Time
Shadow Day
CAD Basics
Coffee Hour with Faculty
How to be more assertive
UROC - Attendance Participation

Spatial Visualization Series
Recap of sessions 1 - 3 from the Fall semester
Two-Axis Rotations and Inclined Planes & Curved Surfaces
Reflection Symmetry & Write a Rule

Career and Professional Development Events
Landing an internship
So, What's Next? Start-Ups, Patents, and Publications
STEM Mixer & Find Your Pack
Interviewing Basics
Building Connections & Networking
Resumes and Cover Letters
...and industry site visits...

Lab Safety Series
Hazard Communication & Hazard Evaluation
Hierarchy of Controls & Basics of PPE
Chemical Waste Management

WIN a gift card. **GAIN** experience.
BUILD your skill set. **ENHANCE** your resume.

And more! For more details, visit:
ess.unm.edu/events *OR* through our web-app - succESS

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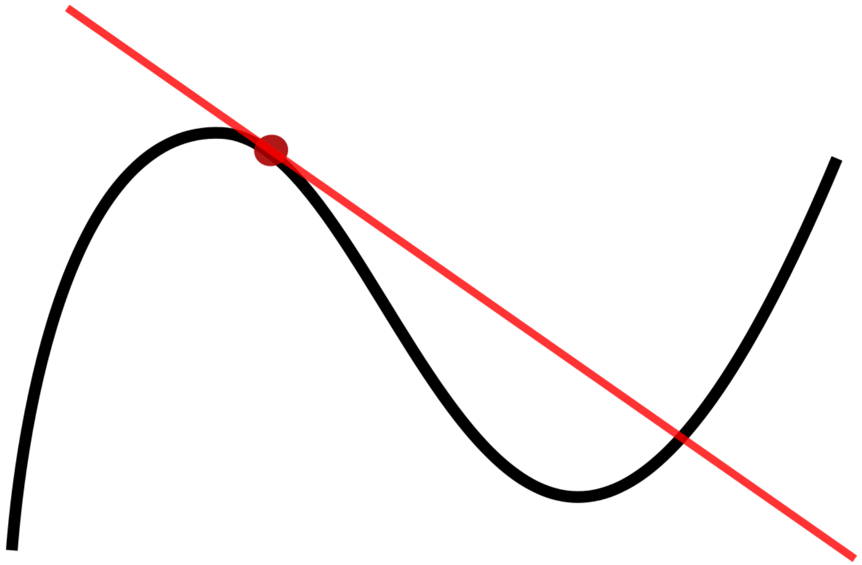
Contents

- Derivatives
  - Optimization
  - Inverse Function Theorem
- Integration
- Graphing

Derivatives

A measure of “slope” or the **rate of change** of a function



Power rule: $\frac{d}{dx}x^n = nx^{n-1}$

$$\frac{d}{dx}5x^{20}$$

Product rule: $\frac{d}{dx}\big(f(x)g(x)\big) = f(x)g'(x) + f'(x)g(x)$

$$\frac{d}{dx} e^{x} \sin(x)$$

Quotient: $\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)f'(x)-f(x)g'(x)}{g(x)^2}$

$$\frac{d}{dx}\frac{2x}{\sin(x)}$$

Chain: $\frac{d}{dx}\left(f\left(g(x)\right)\right) = f'\left(g(x)\right)g'(x)$

$$\frac{d}{dx}\,5(x-3)^2$$

Chain: $\frac{d}{dx}\left(f\left(g(x)\right)\right) = f'\left(g(x)\right)g'(x)$

Quotient: $\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)f'(x) - f(x)g'(x)}{g(x)^2}$

Product rule: $\frac{d}{dx}\left(f(x)g(x)\right) = f(x)g'(x) + f'(x)g(x)$

Power rule: $\frac{d}{dx}x^n = nx^{n-1}$

Which rule(s) do you need to solve these ?

1. $\frac{d}{dx}\frac{3}{x^3}$

2. $\frac{d}{dx}\frac{\sin(x)\cos(x)}{2x}$

3. $\frac{d}{dx}2x\sin(x)\cos(x)$

4. $\frac{d}{dx}\left[\frac{1}{\sin(x)} + \frac{2}{\sin^2(x)}\right]$

1. $\frac{d}{dx}\frac{3}{x^3}$ 2. $\frac{d}{dx}\frac{\sin(x)\cos(x)}{2x}$ 3. $\frac{d}{dx}2x\sin(x)\cos(x)$ 4. $\frac{d}{dx}\left[\frac{1}{\sin(x)}+\frac{2}{\sin^2(x)}\right]$

1. $\dfrac{d}{dx}e^x =$

2. $\dfrac{d}{dx}\sin(x) =$

3. $\dfrac{d}{dx}\cos(x) =$

4. $\dfrac{d}{dx}\ln(x) =$

Inverse Function Theorem

$$(f^{-1})'(x) = \left[f'\left(f^{-1}(x)\right)\right]^{-1} = \frac{1}{f'\left(f^{-1}(x)\right)}$$

Need to find

- $f'(x)$
- $f^{-1}(x)$

Inverse function theorem: $(f^{-1})'(x) = \left[f'\left(f^{-1}(x)\right)\right]^{-1} = \frac{1}{f'\left(f^{-1}(x)\right)}$

Find $(f^{-1})'(x)$

$$f(x) = e^x$$

Inverse function theorem: $(f^{-1})'(x) = \left[f'\left(f^{-1}(x)\right)\right]^{-1} = \frac{1}{f'\left(f^{-1}(x)\right)}$

Find $(f^{-1})'(x)$

$$f(x) = 2x^2 + 4$$

Coffee
BREAK

Optimization

Is the problem asking you to take a derivative?

- “Find the maximum”
- “The largest possible…”

Optimization

Find two positive numbers whose sum is 50 and whose product is as large as possible.

Optimization

A car rental company charges its customers x dollars per day, where $60 \leq x \leq 150$. It has found that the number of cars rented per day can be modeled by the linear function $n(x) = 750 - 5x$. How much should the company charge each customer to maximize revenue?

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Integrating with U substitution

$$\int f\big(g(x)\big)g'(x)dx = \int f(u)du\,,\ u = g(x),\ du = g'(x)$$

Do you see the derivative of some part of the function also in the function?

U-sub: $\int f\big(g(x)\big)g'(x)dx = \int f(u)du\,,\ u = g(x),\ du = g'(x)$

$$\int 2x(x^2+4)^3dx$$

U-sub: $\int f\big(g(x)\big)g'(x)dx = \int f(u)du\,,\ u = g(x),\ du = g'(x)$

$$\int \sin(x)\cos^2(x)\,dx$$

Integrating by parts

$$\int udv = uv - \int vdu$$

(ultra-violet voodoo)

Two expressions multiplied together

(think of a product rule)

To choose u:

L – logarithmic function

I – inverse trig function

A – algebraic function

T – trig function

E – exponential function

Int by parts: $\int \boldsymbol{u}\boldsymbol{dv} = \boldsymbol{uv} - \int \boldsymbol{v}\boldsymbol{du}$

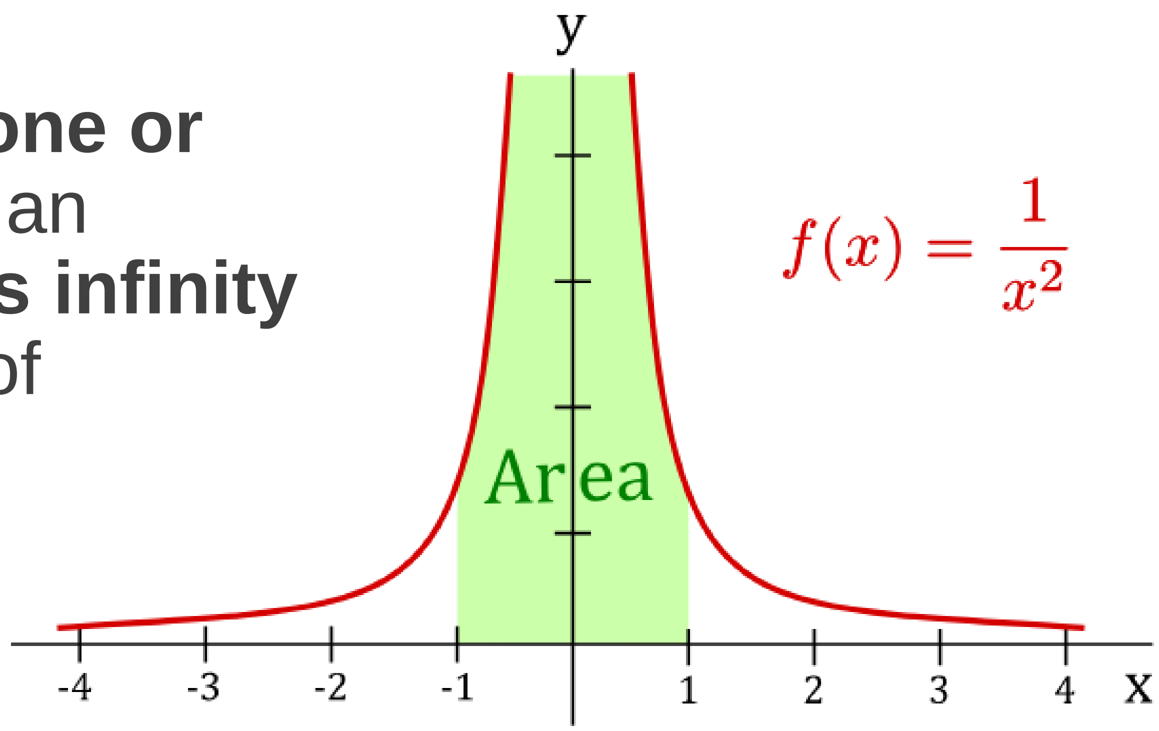
$$\int x \sin(x)\, dx$$

Int by parts: $\int \boldsymbol{u}\boldsymbol{d}\boldsymbol{v} = \boldsymbol{u}\boldsymbol{v} - \int \boldsymbol{v}\boldsymbol{d}\boldsymbol{u}$

$$\int x^2 e^x dx$$

Improper Integrals

A definite integral that has **one or both bounds at infinity** or an **integrand that approaches infinity** at some point in the range of integration



Improper integrals

$$\int_0^\infty x^2 dx$$

Improper integrals

$$\int_{-\infty}^{\infty} \frac{1}{1+x^2}\,dx$$

Notes on Integrals

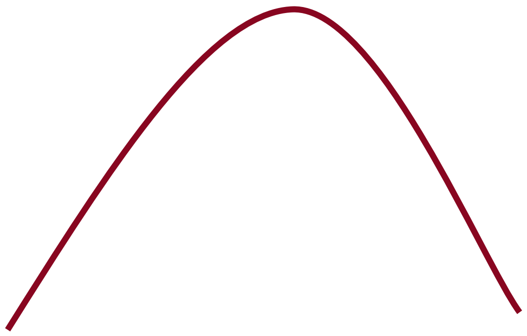
$$\int_{-a}^{a} (odd\ function)\, dx = 0$$

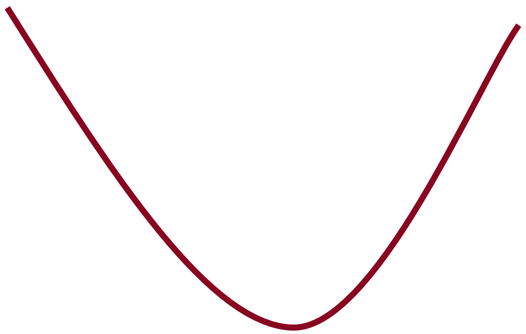
$$\int_{-a}^{a} (even\ function)\, dx = 2\int_{0}^{a} (even\ function)\, dx$$

Look for areas of integration that make shapes! Solve by area!

Graphing with Derivatives

Slope: + - - +

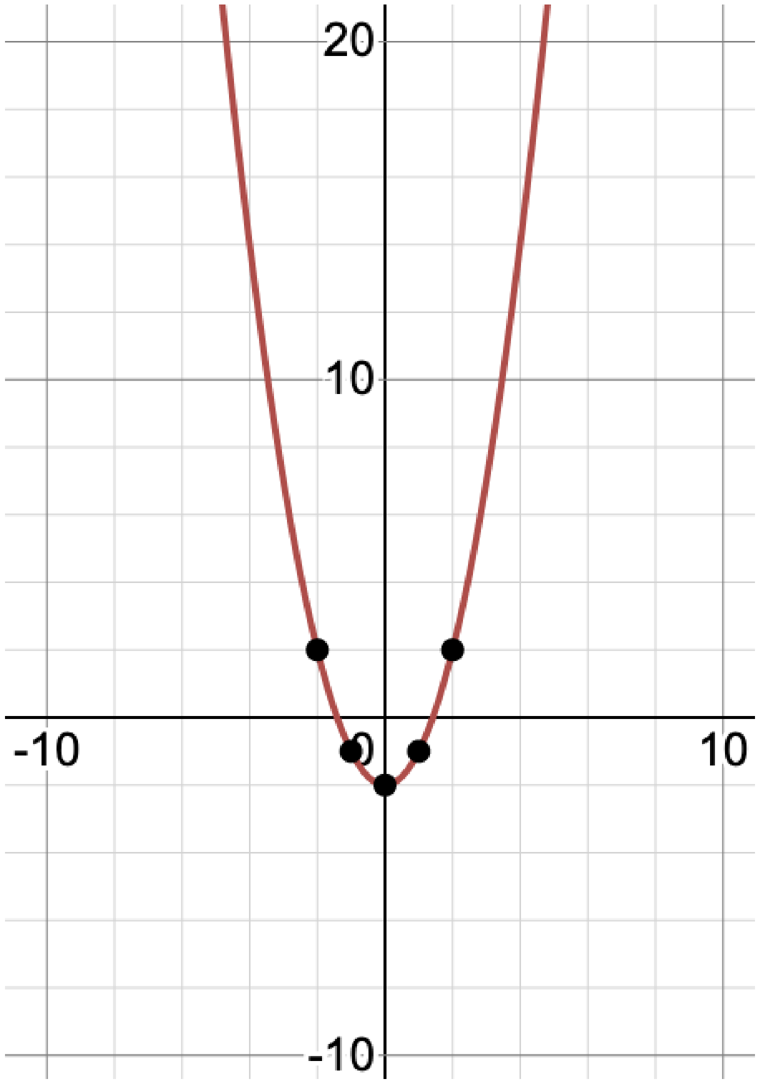




Critical pts: Max Min

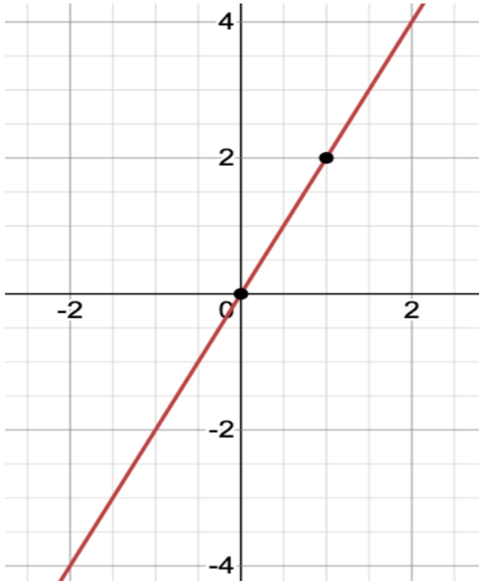
Inflection pts: concave down concave up

$f(x) =$

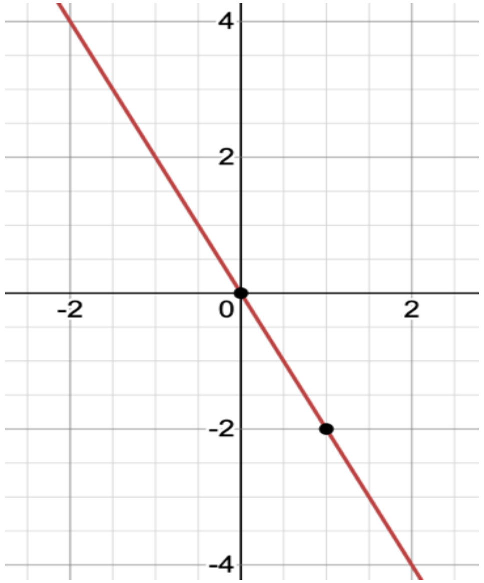


Is f'(x) a or b?

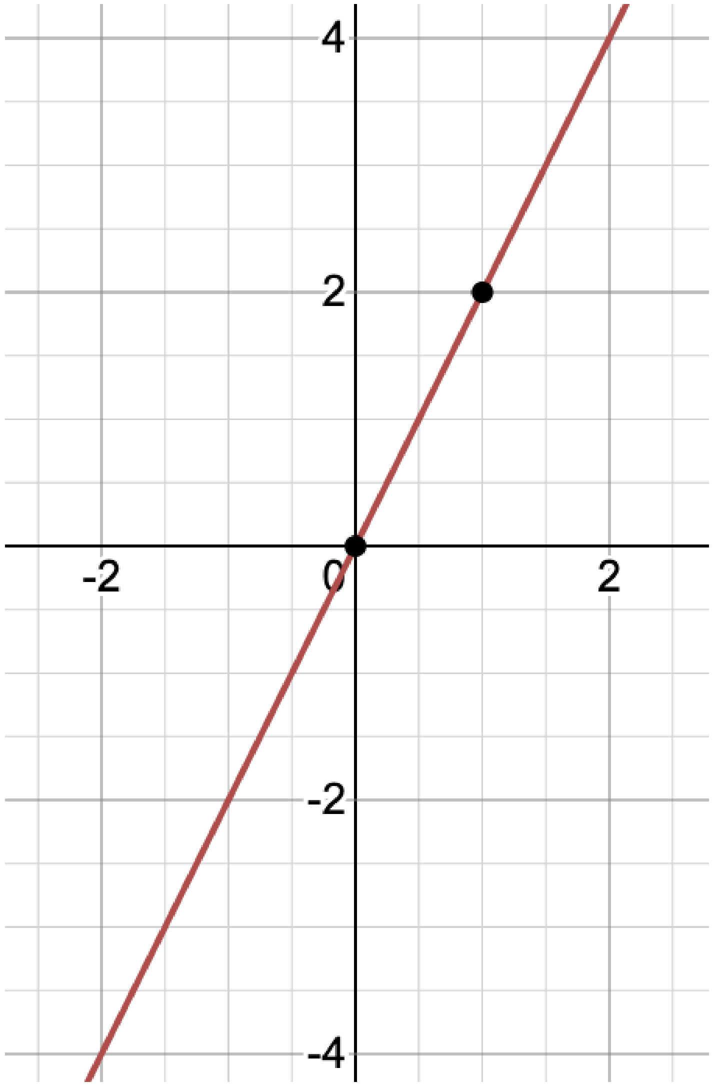
a.



b.

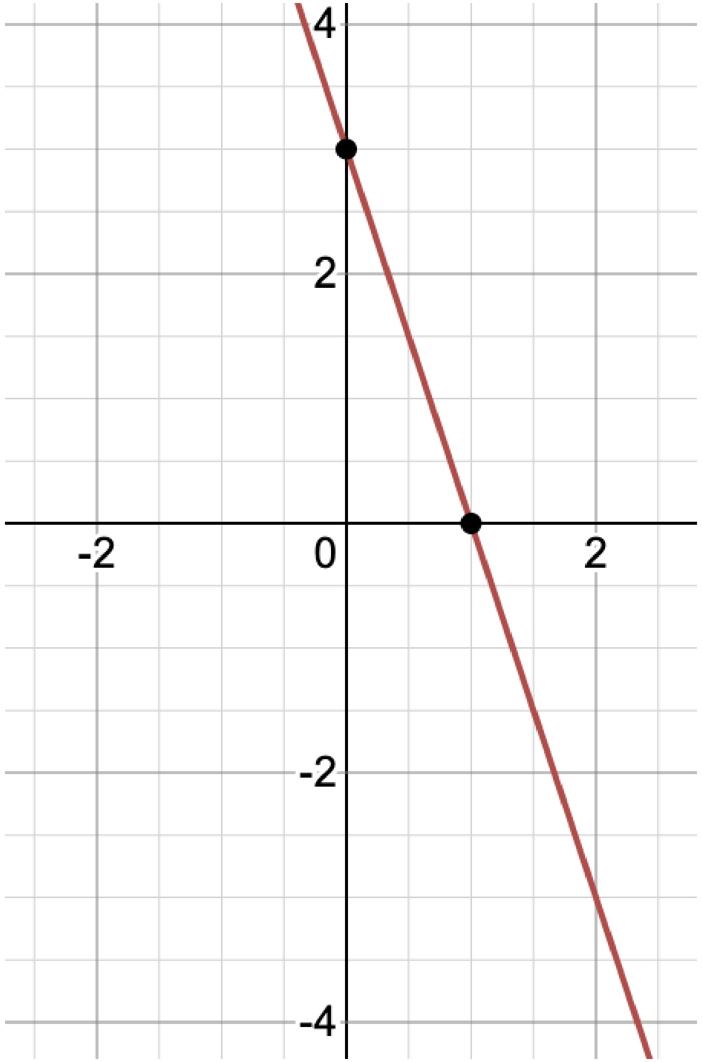


$f(x) =$



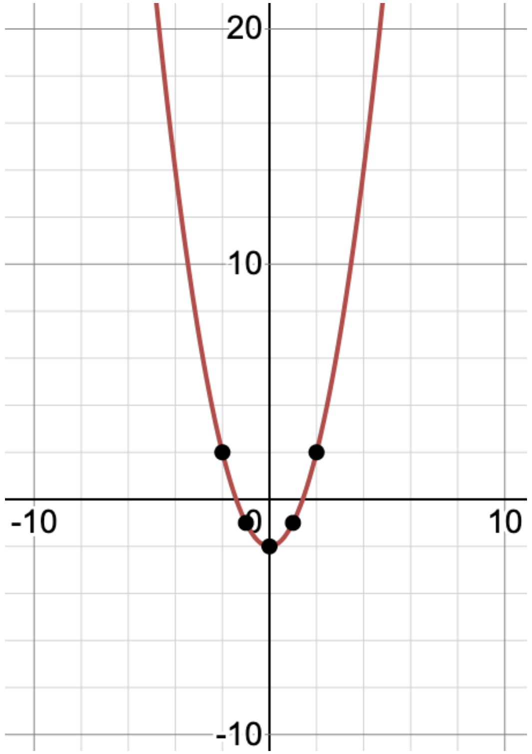
Graph f'(x)

$f'(x) =$

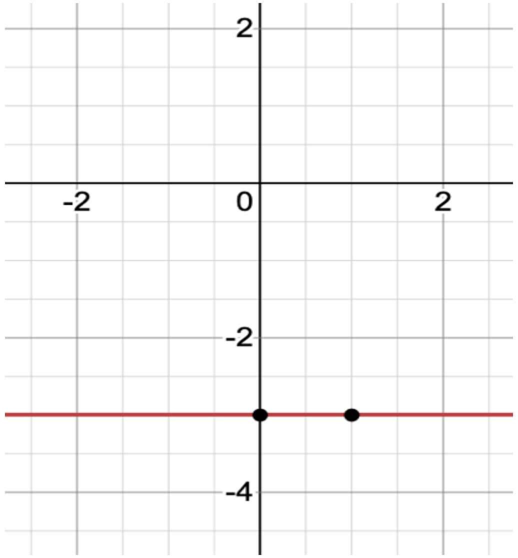


Is f(x) a, b, or c?

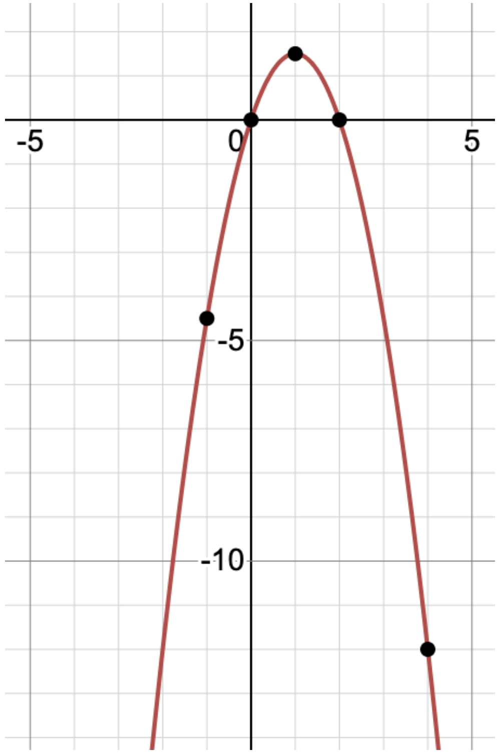
a.



b.



c.



Study Tips

What you can do before the semester

Mentality	Be proactive
Review	Review the self-evaluation
Explore	Explore online resources
Converse	Talk to your professor and TA
Locate	Find resources on campus, such as CTL and tutoring
Study	Form a study group, develop a study plan

Throughout the semester

GO TO CLASS

STAY ON TOP OF HOMEWORK

GO TO PROFESSOR AND TA OFFICE HOURS, CTL, CALC TABLE.

THE UNIVERSITY OF NEW MEXICO

Engineering Student Success Center | CTL Undergraduate Support

Start Your Semester Off Right

Join us for a *FREE*

Pre-Semester Prep Workshop Series

These interactive workshops will review all foundational material leading up to the specified course so you are better equipped to hit the ground running.

Synchronous in-person in the ESS suite & virtual via Zoom

+Pre-Calc/Trig Prep	Monday, August 14, 2023	10 AM - 12 PM
+Calc 1 Prep	Tuesday, August 15, 2023	10 AM - 12 PM
+Calc 2 Prep	Wednesday, August 16, 2023	10 AM - 12 PM
Calc 3 Prep	Thursday, August 17, 2023	10 AM - 12 PM
Math working session	Thursday, August 17, 2023	1 - 3 PM
+Physics 1 Prep	Friday, August 18, 2023	10 AM - 12 PM
Chem 1 Prep	Friday, August 18, 2023	1 - 3 PM

+Attend these sessions & give feedback for access to a general knowledge exam.

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RSVP is preferred but not required

ess.unm.edu/events > August

or through our web-app - succESS

Questions?

Give feedback.

Win a gift certificate!

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Don't forget to follow up on social media.

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