GREAT CALCULUS MYSTERY (TEACHER GUIDE)

Below are the "keys" to unlock each screen for this Desmos Classroom activity. Students receive feedback at the bottom of each screen. They should not proceed to the next screen until they get the correct answers on the current screen.

Screen 1: Welcome

Students are expected to read the directions and press the "I'm Ready" button.

Screen 2: Introduction (Story)

Students can select either option: "Isaac Newton" or "Gottfried Leibniz" as who they think is the founder of calculus. Once they have made a selection, they are not able to change their selection but are now able to go to the next screen.

Screen 3: Introduction (Calculus)

Students need to answer questions 1–4 from their Great Calculus Mystery handout. The example from the handout is modeled in Desmos to guide students on how to enter their answer into the activity.

Directions: Find the general antiderivative for each of the following.

Question #	Antiderivative = $F(x)$
Example	$\frac{1}{3}x^3 + \sin x + C$
1	$5x^2 + C$
2	$-2x^{-\frac{1}{2}} + C \ or \ \frac{-2}{\sqrt{x}} + C$
3	$\frac{9}{5}x^5 - 2x^3 + x + C$
4	$-\cos x + \sin x + C$

*Students can enter an upper-case or a lower-case "c;" either is accepted.

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Screen 4: By the River (Story)

Students are asked what "standing upon the shoulders of giants" might mean. Students need to select "Isaac Newton recognized that his discoveries in calculus would not have been possible without the contributions of earlier mathematicians."

Screen 5: By the River (Calculus)

Students need to answer questions 5–8 from their Great Calculus Mystery handout. The example from the handout is modeled in Desmos to guide students on how to enter their answer into the activity.

Directions: For each integrand given below, identify u and du.

Question #	u	du
Example	$\tan x$	$\sec^2 x\,dx$
5	$x^4 + 8$	$4x^3 dx$
6	$\sin(2x)$	$\cos(2x) \cdot 2dx$
7	$x^{-1} + 3$	$-x^{-2}\,dx$
8	$(2x+1)^{\frac{1}{2}}$	$(2x+1)^{-\frac{1}{2}}\,dx$

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Screen 6: Instigator in Our Midst (Story)

Students are asked what they think Fatio is doing in Newton's apartment. Students need to select "Fatio seems to believe that Newton has his own original calculus ideas, similar to those of Leibniz."

Screen 7: Instigator in Our Midst (Calculus)

Students need to answer questions 9–12 from their Great Calculus Mystery handout. The example from the handout is modeled in Desmos to guide students on how to enter their answer into the activity.

Directions: Rewrite each integral given below using u-substitution.

Question #	Coefficient	Integrand
Example	-1	u^4
9	$\dfrac{1}{3}$	$\cos u$
10	$-\dfrac{5}{2}$	$u^{\frac{1}{3}}$
11	1	$\sec^2 u$
12*	$-\dfrac{1}{3}$	u^{-2}

Keep in mind that there is flexibility regarding where students write their coefficient, due to the properties of integrals. For this activity, encourage students to write their integrals such that any coefficient would be in front of the integral sign to more easily identify that coefficient.

There is more than one correct approach. The most common approach is selecting $u = \cos\left(x^3 + 1\right)$; however, if students choose $u = x^3 + 1$, then the coefficient would be $+\dfrac{1}{3}$ and the integrand would be $\sec(u) \cdot \tan(u)$. Desmos will accept either set of answers.

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Screen 8: False Accusations (Story)

Students are asked if they think Leibniz is truthful when he claims that he did not plagiarize. Students need to select "Yes, Newton and Leibniz both seemed to have discovered calculus in different parts of the world around the same time."

Screen 9: False Accusations (Calculus)

Students need to answer questions 9–12 from their Great Calculus Mystery handout. The example from the handout is modeled in Desmos to guide students on how to enter their answer into the activity.

Directions: Evaluate each indefinite integral.

Question #	Antiderivative = $F(x)$
Example	$-\dfrac{1}{8}\left(\cos(4x)\right)^{-2}+C \ or \ \dfrac{-1}{8\cos^{2}(4x)}+C$
13	$\sqrt{2x}+C$
14	$-3\cos x-\dfrac{1}{2}\sin(2x)+C$
15	$3x^{2}-\sqrt{9-x^{2}}+C$
16	$2x^{\frac{9}{2}}+\dfrac{12}{5}x^{\frac{5}{2}}+2x^{\frac{1}{2}}+C$

Screen 10: A Modern Hero (Story)

Students are asked who they believe is the founder of calculus and to share their reasoning. Students can select any option: "Isaac Newton," "Gottfried Leibniz," or "Both Newton and Leibniz," as who they think is the founder of calculus. Once they have made a selection, they are reminded to turn in their scratch work.