Mathematics Placement Assessment

Middlebury College

Instructions

All students interested in taking a MATH course are required to complete the Math Placement Survey. The Math Placement Survey is designed to help capture your current mathematical knowledge so we can match you with a mathematics course that fits your preparation and will help you advance your goals. The survey includes questions about your past math classes and test scores, and may ask you to try some exercises and upload scans of your work.

- You should have a pencil/paper or a tablet/stylus ready to write out your work for math problems. You may be prompted to upload some of your work.
- **Do not use a calculator or any other technological aids, such as Desmos, Chat GPT, or any web-based tools** (using a stylus/tablet as your writing tool is okay!). The questions are designed to be completed without these tools. Most MATH classes at Middlebury do not permit you to use these tools on assessments. You need to work on the survey using only your writing tools (pen/paper, stylus/tablet) to best capture your mathematical knowledge as it relates to our coursework.
- **The survey has no time limit — you can take as long as you need**. Most students set aside 15–60 minutes to complete the survey, though your personal timing will vary based on a variety of factors including which math courses you've previously taken and how much you remember.
- **Be honest about what you know—and what you don't**. Placing into a course for which you are not prepared may result in a low grade or no credit, potentially setting you back in your academic plans. Placing into a course for which you have already mastered the material is detrimental both to you, because it does not advance you along your academic path, and to other students in the class, who are learning the material for the first time.
- As you go, mark each exercise as **Green**, **Yellow**, or **Red**.
  - **Green** indicates you confidently found the answer. You should actually find the answer.
  - **Yellow** indicates you think you could answer this question after some review. You've seen this before but don't remember all the details. You should actually do as much of this problem as you can.
  - **Red** indicates you have never seen questions of this type before and don't know how to proceed.

DO NOT USE A CALCULATOR

Part A (For Everyone)

(1) Evaluate $\dfrac{\frac{1}{6}+\frac{2}{3}}{2}$

(2) Find an equation for the line that passes through point (1, 2) with slope $m = -1$.

(3) Find any solution(s) to the system $-2x + 3y = 11$ and $4x - y = 3$

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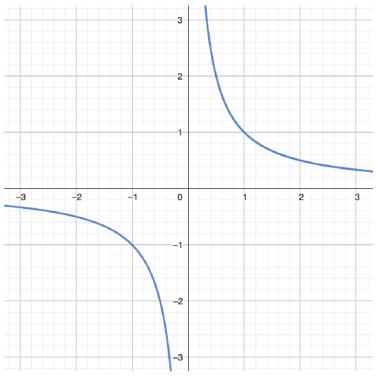
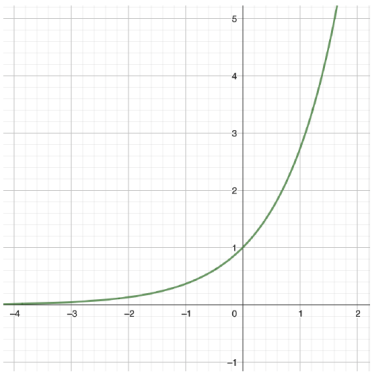
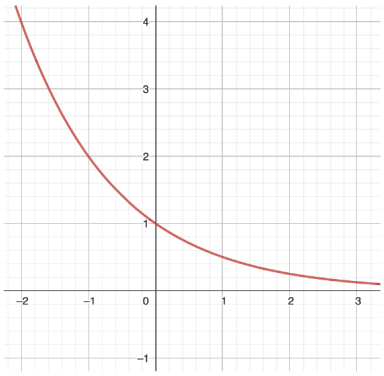
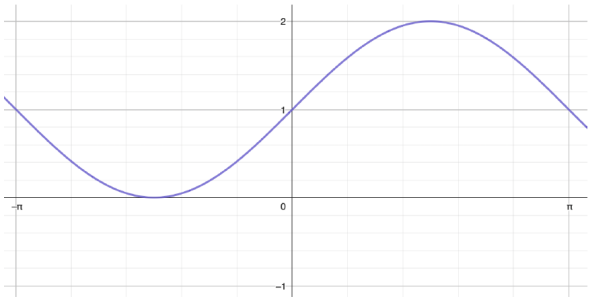
(4) Match each of the following functions with one of the given graphs. Do not use a graphing calculator.

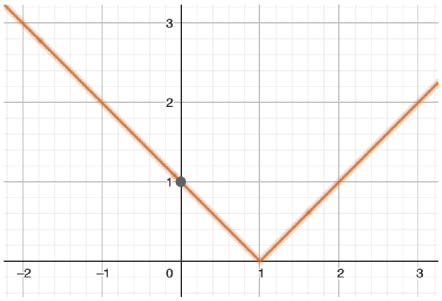
$f_1(x) = \sin(x) + 1,\ f_2(x) = e^x,\ f_3(x) = \frac{1}{x},\ f_4(x) = 2^{-x},\ f_5(x) = |x - 1|$











(5) Find any solution(s) to $x^2 - 7x - 8 = 0$

(6) Find any solution(s) to $x^3 - 25x = 0$

DO NOT USE A CALCULATOR

(7) Rewrite the following expression in a single rational expression, $\dfrac{\text{numerator}}{\text{denominator}}$

$$\frac{1}{(x+2)^2} - \frac{x}{x+2}$$

(8) Which of the following expressions are equivalent to $\frac{x^3(3x-7)}{x^2-2}$? Select all that apply.

a. $x^3\dfrac{(3x-7)}{x^2-2}$

b. $\dfrac{x(3x-7)}{-2}$

c. $\dfrac{1}{x^2-2}x^3(3x-7)$

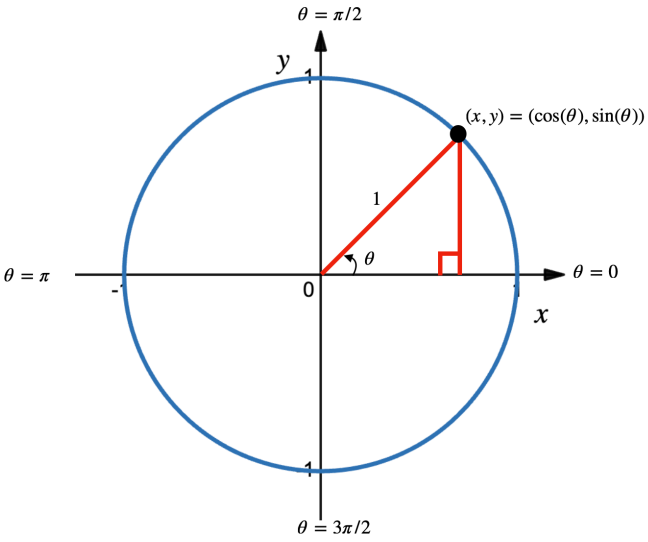
d. $\dfrac{3x^4-7x^3}{x^2-2}$

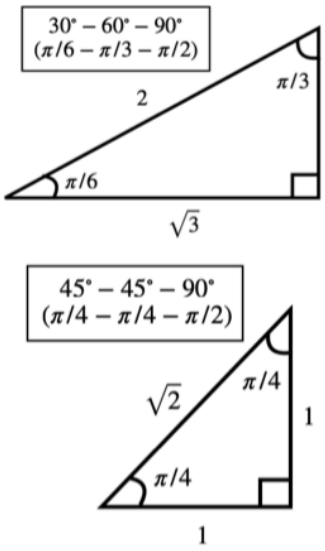
e. $\dfrac{x^3(3x-7)}{x^2} - \dfrac{x^3(3x-7)}{2}$

f. $\dfrac{3x^4}{x^2-2} - \dfrac{7x^3}{x^2-2}$

(9) Simplify: $\dfrac{x^2-9}{x^2-x-6}$

(10) Use only the figures below depicting the basics of the unit circle and two special triangles to help you evaluate the following trig functions.





a. $\sin(5\pi/6)$

b. $\cos(-\pi/4)$

c. $\tan(5\pi/4)$

(11) Find at least two solutions to $0 = 1 + 2\cos(x)$. Feel free to refer to the unit circle and special triangles above.

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(12) Simplify:

a. $\dfrac{(6x)^2}{\sqrt{x}}$ as an expression of the form $c \cdot x^k$.

b. Simplify $\dfrac{(2x^2)^3 y^{-1}}{\sqrt{xy}}$ as an expression of the form $c \cdot x^k y^m$.

(13) Evaluate

a. $e^0 =$

b. $\ln(e^3) - \ln(1) =$

(14) Is $\sqrt{x^2 - 9}$ equal to $x - 3$? Why or why not?

(15) Find all the solution(s) for x in the equation $2x^2 \ln(x) - 4x^2 = 0$

When you are finished Part A...

If the majority of the problems are green or yellow, it's likely that you would place out of MATH 102 and MATH 103 (Logs, Exponents, and Functions).
You next step will depend on whether or not you've taken a previous course in Calculus.

- If you have previously not taken a course in Calculus, you should submit your work on Part A now. https://go.middlebury.edu/MATHpreapproval
- If you have previously taken a course in Calculus, you should submit your work on Part A and proceed to Part B.

DO NOT USE A CALCULATOR

Part B (Only for those who have previously taken Calculus I)

(16) Find the derivative of $f(x) = 3x^5 - \dfrac{10}{x^2} + 7$

(17) Find the derivative of $f(x) = \sqrt{x^2 + 1}$. Use this to find the equation of the tangent line at $x = 0$.

(18) Find the derivative of $f(x) = \dfrac{x^2 \sin x}{\ln x}$

DO NOT USE A CALCULATOR

(19) Evaluate: $\lim_{x\to 3} \dfrac{x^2-9}{x-3}$

(20) Evaluate: $\lim\limits_{x\to 1} \dfrac{\frac{1}{2}-\frac{1}{x+1}}{x-1}$

(21) Evaluate the following limit. If the limit does not exist determine if it is $+\infty$, $-\infty$ or neither.

a. $\lim\limits_{x\to 1^+} \dfrac{1}{x-1}$

b. $\lim\limits_{x\to -\infty} \dfrac{1}{e^x+2}$

(22) Determine whether the function below is continuous at $x = 1$

$$f(x) = \begin{cases} x^2 + 3, & x < 1 \\ 2x + 1, & x \geq 1 \end{cases}$$

(23) Find $\frac{dy}{dx}$ (otherwise known as y') for $x^2 + 2xy + y^2 = 9$

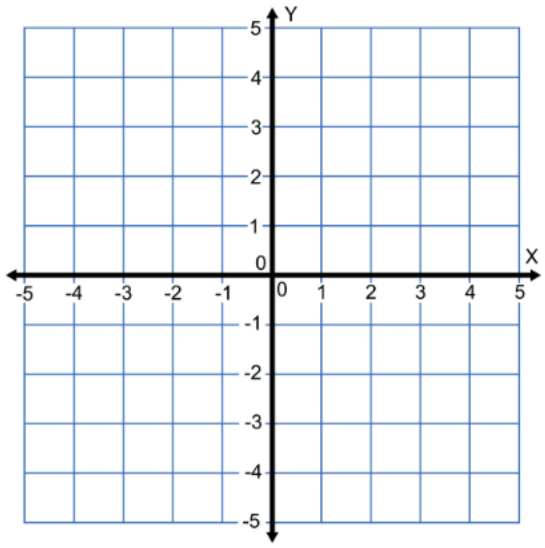
(24) Determine any local maximums and minimums of $f(x) = x^4(x - 5)$

DO NOT USE A CALCULATOR

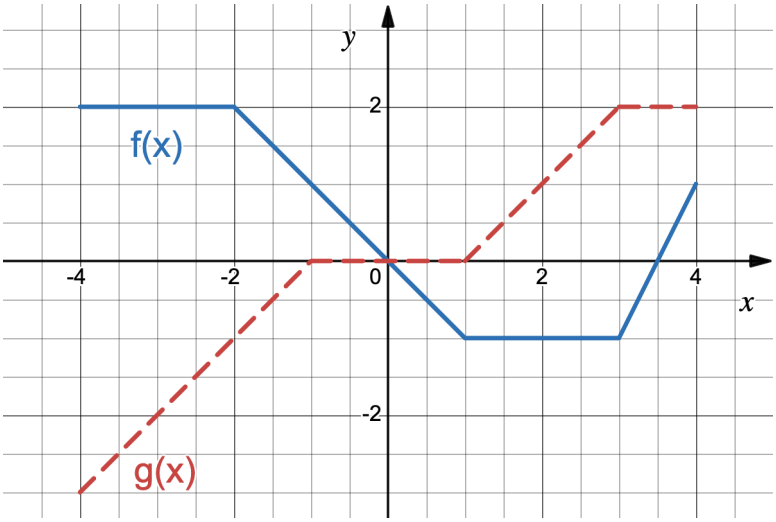
(25) Evaluate: $\int x^3 - 2e^x + \frac{1}{x^2}\,dx$

(26) Evaluate: $\int \sin(2x)\,dx$

(27) Graph $y = x^2$ and $y = 4$. Find and label the points of intersection. Find the area between the curves using an integral.



(28) The graphs of two functions $y = f(x)$ (solid line, blue) and $y = g(x)$ (dashed line, red) are given below. Use the graphs to evaluate the following integrals.



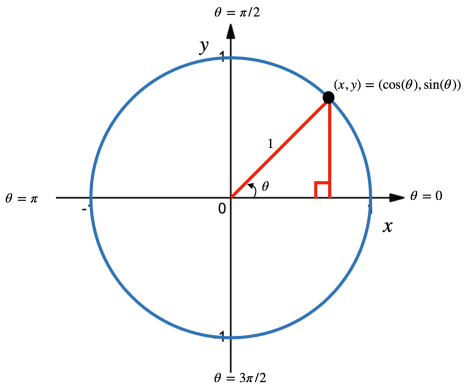
a. $\displaystyle\int_{-4}^{4} f(x)\,dx$

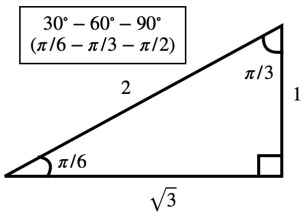
b. $\displaystyle\int_{0}^{4} (2f(x) + g(x))\,dx$

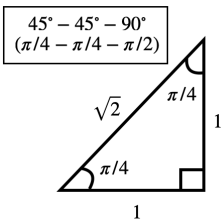
c. $\displaystyle\int_{2}^{0} (g(x) - f(x))\,dx$

(29) Evaluate: $\displaystyle\int_{1}^{4} \left(\frac{5}{\sqrt{x}} + 2x - 3\right) dx$

(30) Use only the figures below that depict the basics of the unit circle and two special triangles to help evaluate the following trig and inverse trig functions.







a. $\sec(2\pi/3)$

b. $\arcsin(-1/2) = \sin^{-1}(-1/2)$

c. $\arctan(\sqrt{3}) = \tan^{-1}(\sqrt{3})$

When you are finished Part B...

If the majority of the problems are green or yellow, it's likely that you would place out of MATH 121 (Calculus I).

- If you have never taken a Calculus II course, you submit your work for Part B now: https://go.middlebury.edu/MATHpreapproval
- If you have taken a Calculus II course, submit your work for Part B now, proceed to Part C.

Part C (Only for those who have previously taken Calculus II)

(31) Find the derivative of $f(x) = \sqrt{\ln(x)}$

(32) Evaluate: $\int \sqrt{x}(x^2 - 4)^2 dx$

(33) Evaluate: $\int x\sqrt{3x^2 + 5}dx$

(34) Evaluate: $\int \sin^2(x)\cos(x)dx$

DO NOT USE A CALCULATOR

(35) Evaluate: $\int \sqrt{1-4x^2}dx$

(36) Evaluate: $\int_0^{\pi} x^2 \sin(x)dx$

(37) Find the particular solution to $\frac{dy}{dx} = x^2 - 3$ where y(0)=1

(38) Determine whether the following series converges or diverges. If it converges, determine if it converges conditionally or absolutely. $\sum_{n=1}^{\infty}(-1)^n \frac{n}{n^2+1}$

(39) Determine whether the following series converges or diverges. If it converges, determine if it converges conditionally or absolutely. $\sum_{n=1}^{\infty}(-1)^n \frac{3^n}{\sqrt{n}}$

(40) Compute the Taylor series expansion about $x = 1$ for $f(x) = \ln(x)$

When you are finished Part C...

If the majority of the problems are green or yellow, it's likely that you would place out of MATH 122 (Calculus II). Submit your work for Part C now. https://go.middlebury.edu/MATHpreapproval