



Dear Prospective Advanced Placement Calculus AB Student:

Congratulations on committing to a rigorous course of study that may get you further in college math than you ever thought you could reach in high school. The study of calculus will draw on so much prior experience from Algebra (IM1, IM2, and IM3), Geometry (IM1 and IM2), Trigonometry (IM2 and IM3), and Pre-Calculus (IM3). The course will be taught at a college level and, as such, this background knowledge is expected and will not be retaught. Since this is a college course, the grade requirements and calculation will be different than your regular high school courses.

The following packet was designed to help you remember the very basics of what you are supposed to know. This represents the very minimum of what you should complete over the summer. If you have difficulty on some of the subjects, try these websites to watch videos and tutorials as well as getting some practice problems with answers and immediate feedback.

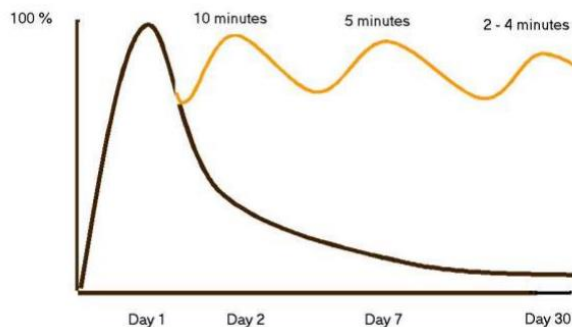
- 1) Hippo Campus: <http://www.hippocampus.org/>
- 2) Khan Academy: <https://khanacademy.org/>
- 3) Wolfram Alpha: <http://www.wolframalpha.org/>

Of course you can use other options to refresh your learned knowledge but it is up to you to know, retain, and be able to use the prerequisite knowledge from previous years.

Calculus is NOT a required course at BMHS. Therefore, be sure you want to take this course. Have a GOOD reason to take AP Calculus AB. You should take this course because:

- 1) You want to be an engineer;
- 2) You want to enter a STEM career;
- 3) You want to complete all your math requirements BEFORE you enter college;
- 4) You love math;
- 5) You enjoy the subject and all it has to offer.

If you take this course for your parents, because 'someone' said you should, because you have an extra free hour in your schedule, because you have friends in the course, etc. – it will lead to low grades and outcomes unless you truly dedicate yourself to learning the material. This course requires constant practice – not watching the teacher do problems but also practicing the new concepts and reviewing notes DAILY.



This is the Curve of Forgetting (AVID). This trend says if we do NOT revisit what we have learned within 24 hours of learning it, we will forget 50-80% of the new information.

Our brain is always taking in new information. If we do not revisit the new information in 24 hours, our brain will dump this information, because it is scrap, and replace it with new. Just reviewing my schoology notes for 20 minutes a day is a great way to retain what you learn daily.

The following pages contain the functions you need to know, some general terms, formulas, or concepts, as well as practice problems. Please work on this packet throughout the summer and bring it COMPLETED on the first day of school in Fall 2019.

Calculus Prerequisite Assignment

Directions: It is expected that you answer each of these questions without a calculator! Simplify each expression:

1) True or False: The function $f(x) = x^4 + x^2 + x$ is an even function. PROVE!	2) True or False: The function $f(x) = x^{-3}$ is an odd function. PROVE!
3) $\frac{(9x^2 - 3x - 2)(3x^2 - 10x - 8)}{(9x^2 - 4)(27x^3 + 1)} =$	4) Which of the following gives the domain of $f(x) = \frac{x}{\sqrt{9 - x^2}}$? (A) $x \neq \pm 3$ (B) $(-3, 3)$ (C) $[-3, 3]$ (D) $(-\infty, -3) \cup (3, \infty)$ (E) $(3, \infty)$
5) $1 - \frac{4}{x} = \frac{5}{6}$	6) Which of the following gives the range of $f(x) = 1 + \frac{1}{x-1}$? (A) $(-\infty, 1) \cup (1, \infty)$ (B) $x \neq 1$ (C) all real numbers (D) $(-\infty, 0) \cup (0, \infty)$ (E) $x \neq 0$

7) Solve: $x^4 - 10x^2 + 29 = 8$	8) Solve: $2x^3 - 10x^2 - 48x = 0$
9) If $f(x) = 2x - 1$ and $g(x) = x + 3$, which of the following gives $f(g(2))$? a) 2 b) 6 c) 7 d) 9 e) 10	10) The length L of a rectangle is twice as long as its width W . Which of the following gives the area A of the rectangle as a function of its width? a) $A(W) = 3W$ b) $A(W) = \frac{1}{2}W^2$ c) $A(W) = 2W^2$ d) $A(W) = W^2 + 2W$ e) $A(W) = W^2 - 2W$

Match the function with its graph. Do not use a graphing calculator.

11) $y = 2^x$ _____

12) $y = 3^{-x}$ _____

13) $y = -3^{-x}$ _____

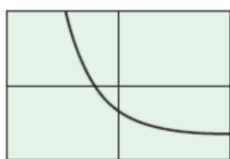
14) $y = -0.5^{-x}$ _____

15) $y = 2^{-x} - 2$ _____

16) $y = 1.5^x - 2$ _____



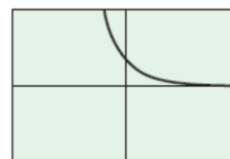
(a)



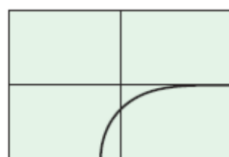
(b)



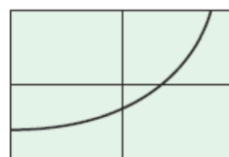
(c)



(d)



(e)



(f)

Exponential and Natural Log Functions:

The natural log and exponential function ($\ln$ and e^x) are commonly used functions in calculus. Some of these items you need to know by heart:

17) $\ln e =$

18) $e^{\ln x} =$

19) $\ln 1 =$

20) $\ln e^x =$

Write out the rules for logarithms

$\ln(a) + \ln(b) =$

$\ln(a) - \ln(b) =$

$a \cdot \ln(b) =$

You also need to be able to manipulate natural log and exponential equations. This means you must be able to solve them. Solve for x:

21) $32 = 8e^x$

22) $\ln 35^x = 9$

23) $8 \ln 2x = 48$

24) $16e^{4x} = 80$

25) $\ln(1) - 4x^2 = \ln\left(\frac{1}{e}\right)$

26) $2 - \ln(7 - x) = 0$

27) $\frac{27}{1 + e^{-x}} = 2$

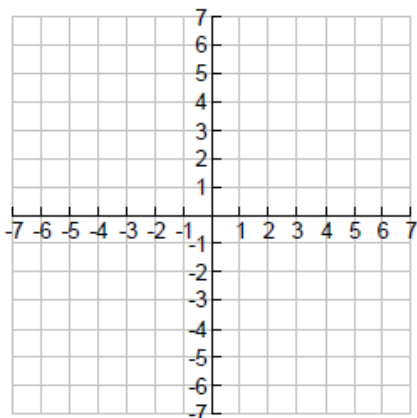
28) $\frac{3}{4} = \frac{2e^x}{8}$

29) **Calculator permitted:** The number of bacteria in a petri dish culture after t hours is

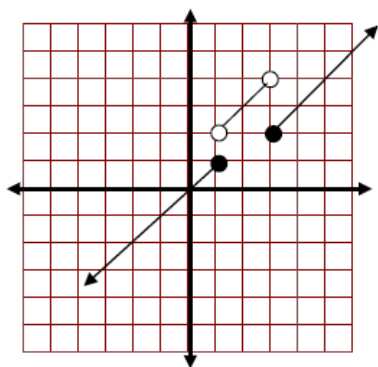
$$B = 100e^{0.693t}$$

- What is the initial number of bacteria present?
- How many bacteria are present after 6 hours?
- Approximately when will the number of bacteria be 200? Estimate the doubling time of the bacteria.

30) Sketch the graph of $f(x) = \begin{cases} \sqrt{4-x} & x \leq 0 \\ 2-3x & 0 < x \leq 2 \\ x^2 & x > 2 \end{cases}$



31) For the graphed piecewise function below, state the equation and its domain.



$$f(x) = \begin{cases} \rule{1.5cm}{0.4pt} \\ \rule{1.5cm}{0.4pt} \\ \rule{1.5cm}{0.4pt} \end{cases}$$

Trigonometry Practice

You should know your unit circle coordinates like the back of your hand. It should not be a guess – you need to KNOW it!

Answer the following and commit to memory! Find domains and ranges. No calculator!

32) $y = \sin x$ D: _____ R: _____

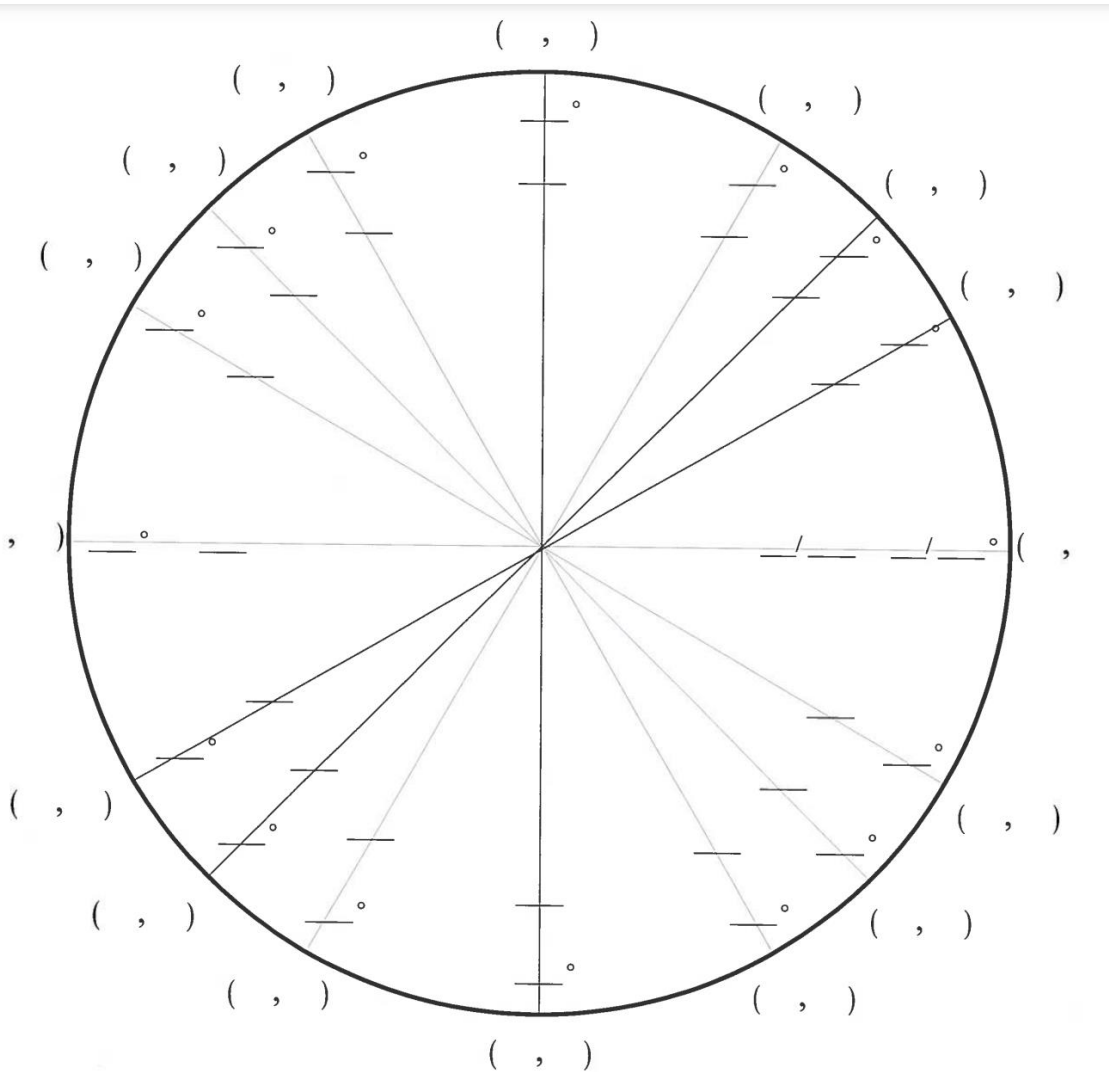
33) $y = \cos x$ D: _____ R: _____

34) $y = \tan x$ Range: _____ Undefined at: _____

Give the values – no calculator.

35) $\sin\left(\frac{\pi}{2}\right)=$	36) $\cos\left(\frac{\pi}{3}\right)=$	37) $\tan\left(\frac{\pi}{4}\right)=$	38) $\sin(\pi)=$
39) $\sin\left(\frac{\pi}{6}\right)=$	40) $\cos(2\pi)=$	41) $\sin\left(\frac{\pi}{3}\right)=$	42) $\cos\left(\frac{2\pi}{3}\right)=$
43) $\tan\left(\frac{\pi}{2}\right)=$	44) $\sin\left(\frac{\pi}{4}\right)=$	45) $\tan(\pi)=$	46) $\cos\left(\frac{3\pi}{4}\right)=$
47) $\tan(2\pi)=$	48) $\tan\left(\frac{3\pi}{4}\right)=$	49) $\cos\left(\frac{3\pi}{2}\right)=$	50) $\cos\left(\frac{\pi}{6}\right)=$
51) $\cos\left(\frac{\pi}{4}\right)=$	52) $\cos\left(\frac{\pi}{2}\right)=$	53) $\cos(\pi)=$	54) $\sin(2\pi)=$
55) $\sin\left(\frac{2\pi}{3}\right)=$	56) $\sin\left(\frac{3\pi}{4}\right)=$	57) $\sin\left(\frac{3\pi}{2}\right)=$	58) $\tan\left(\frac{3\pi}{2}\right)=$

Fill out the unit circle. Avoid using a calculator



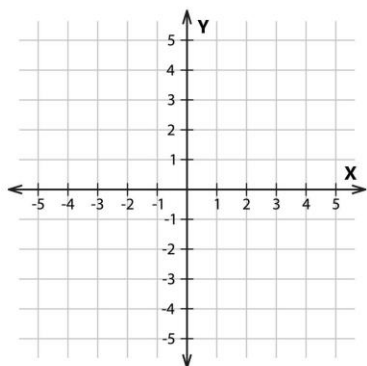
The Radian Measures and Coordinates **MUST** be memorized

Remember: $\sin \theta = \frac{y}{r} = y - \text{coordinate}$, $\cos \theta = \frac{x}{r} = x - \text{coordinate}$, and $\tan \theta = \frac{y}{x} = \frac{y - \text{coordinate}}{x - \text{coordinate}}$

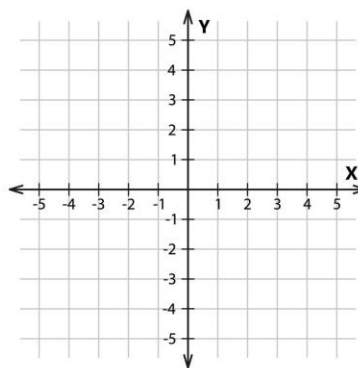
Reciprocal Identities	Quotient Identities	Pythagorean Identities
$\sin x = \frac{1}{\csc x}$ $\csc x = \frac{1}{\sin x}$ $\cos x = \frac{1}{\sec x}$ $\sec x = \frac{1}{\cos x}$ $\tan x = \frac{1}{\cot x}$ $\cot x = \frac{1}{\tan x}$	$\tan x = \frac{\sin x}{\cos x}$ $\cot x = \frac{\cos x}{\sin x}$	$\sin^2 x + \cos^2 x = 1$ $\tan^2 x + 1 = \sec^2 x$ $1 + \cot^2 x = \csc^2 x$

These are the 14 parent functions. Be sure you know their graphs, x and y intercepts, and how their transformations (ex: $f(x) = -4(x-3)^2 - 8$ ← this has stretch of 4, reflected over the x-axis, shift right 3, and shift down 8) changes their parent graph. Graph a sketch of each of the graphs.

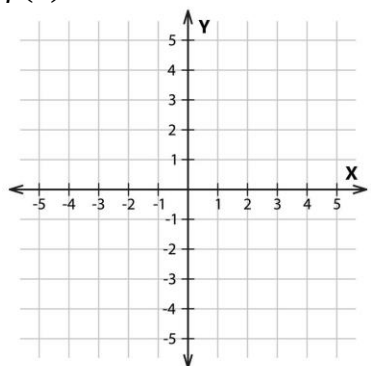
1) $f(x) = c$ (c is a constant, like 4 or -2)



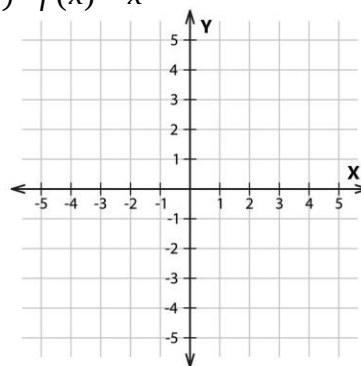
3) $f(x) = x^2$



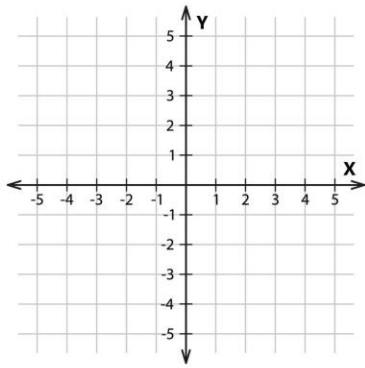
2) $f(x) = x$



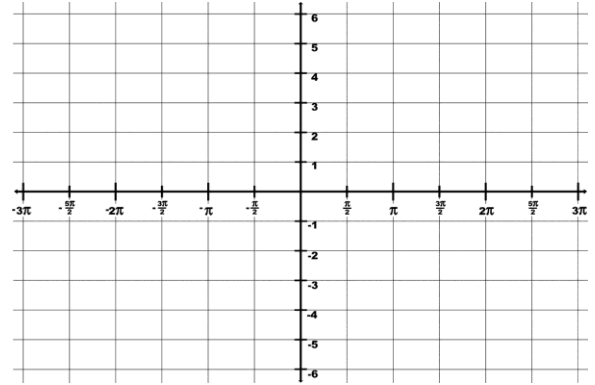
4) $f(x) = x^3$



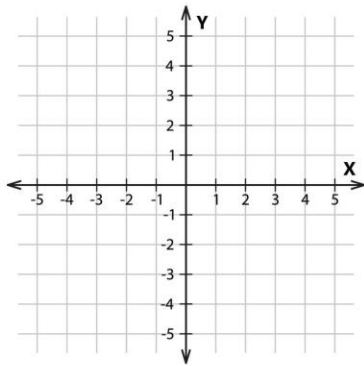
5) $f(x) = \sqrt{x}$



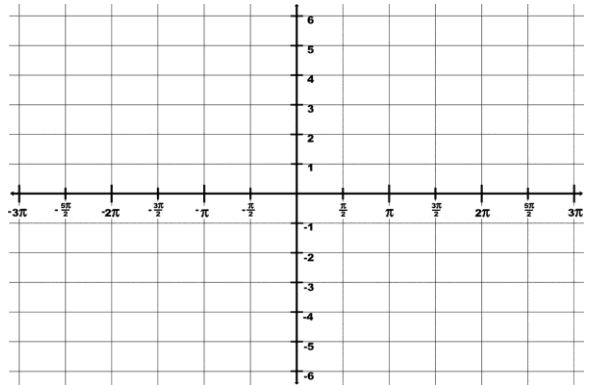
9) $f(x) = \sin x$



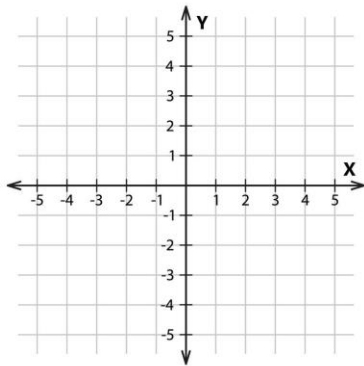
6) $f(x) = \sqrt[3]{x}$



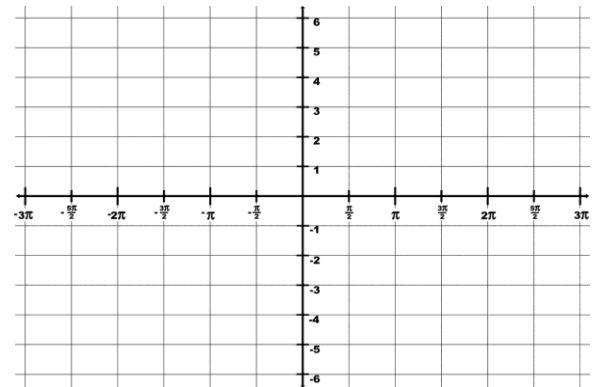
10) $f(x) = \cos x$



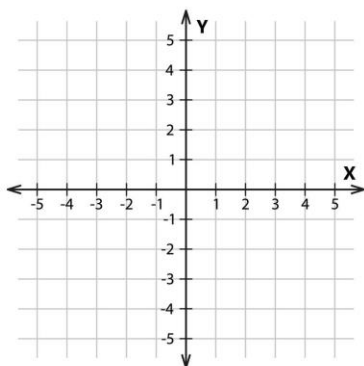
7) $f(x) = \frac{1}{x}$



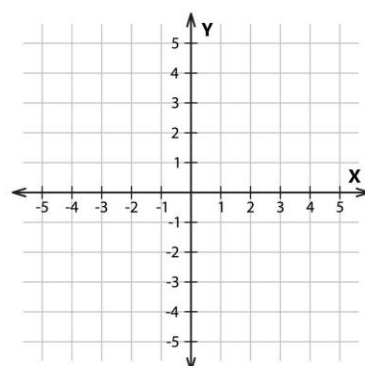
11) $f(x) = \tan x$



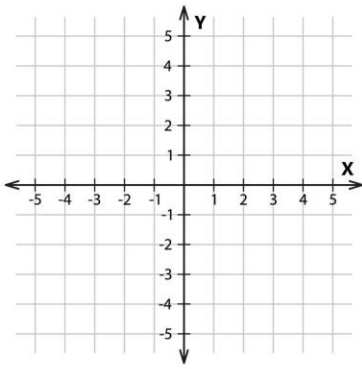
8) $f(x) = \frac{1}{x^2}$



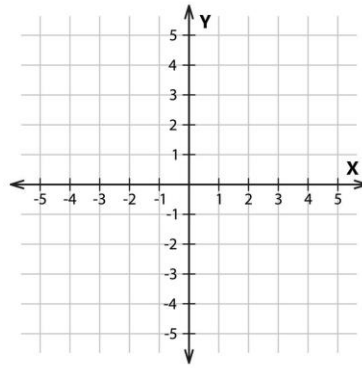
12) $f(x) = |x|$



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

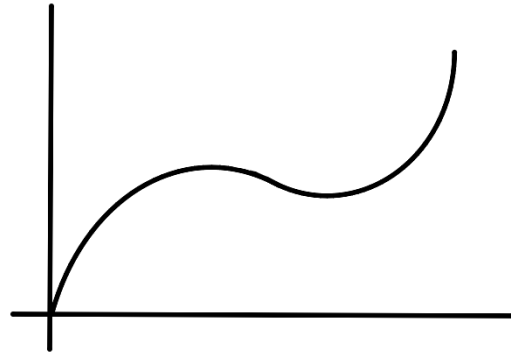


14) $f(x) = \ln x$



Please answer the following miscellaneous questions

1. Fifteen students take a test. How would you calculate the average score?
2. A car travels at 55 mph for 4 hours. How far will it travel?
3. Is there a difference between $\frac{4x^3}{7}$ and $\frac{4}{7}x^3$? Explain yes or no
4. What is a tangent line? What is a secant line? (You might have to google this) Draw an example of each one using the curve below.



5. What is the formula for the area of the following shapes?
 - a. Circle
 - b. Rectangle
 - c. Triangle
 - d. Trapezoid

6. Given $f(x) = x^2 + 4x - \sqrt{x+3}$ find the following

a. $f(1) =$

b. $f(6) =$

c. $f(k) =$

d. $f(3h) =$

e. $f(m-4)$

f. $f(x+h)$

7. How do you find a horizontal asymptote of a rational function? List the 3 situations that occur.

8. What are the definitions of the following things

a. Velocity:

b. Acceleration:

c. Speed:

9. Do the following without a calculator

$$\frac{2}{3} + 1$$

$$\frac{2}{3} - 1$$

$$\frac{8}{5} + 1$$

$$\frac{3}{5} - 1$$

$$\frac{9}{4} - 1$$

10. Evaluate the following exponents

$$3^{-2}$$

$$8^{-1}$$

$$9^{\frac{1}{2}}$$

$$4^{\frac{3}{2}}$$

$$\left(\frac{2}{5}\right)^{-2}$$

$$3^{-2}$$

$$27^{\frac{2}{3}}$$

$$125^{-\frac{2}{3}}$$

$$\left(\frac{4}{3}\right)^3$$

$$100^{\frac{3}{2}}$$

$$\left(\frac{25}{49}\right)^{-\frac{1}{2}}$$

$$\left(\frac{1}{144}\right)^{-\frac{3}{2}}$$