The questions below are organized by category. For each category, you can find a corresponding folder in the D2L review course that points you toward resources to help practice that skill. Take this worksheet as a "pretest" first, and see what areas you need to practice in order to be ready for Calculus 1. Answers are posted, as are video solutions to some of the problems.

Important note: All of these questions were selected because **questions of this type will be embedded inside Calculus 1 questions this semester**. This isn't a review of all mathematics you have learned ever (even though it may feel like it) - it is a review of the exact skills you will need in Calculus 1. *All of the questions should be completed without a calculator.*
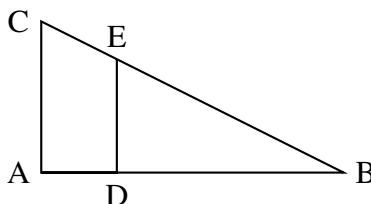
A   Geometry

Question 1. Reviewing lines:

  (a) Find an equation for a horizontal line through the point $(2, -5)$.

  (b) Find an equation for a line through the point $(2, -5)$ that is parallel to the line $2x - 4y = 3$.

Question 2. What is the area of a circle with radius 3? What is the circumference?

Question 3. Sketch the graph of the equation $x^2 + y^2 = 9$. Is it the graph of a function?

Question 4. In the picture below, find the length of AB if DB is $x + 3$ cm, AD is x cm, CB is 7 cm, and EB is 6 cm. Assume that AC and DE are parallel.

B   Trigonometry

Question 5. Write in terms of sine and cosine:

  (a) $\tan x$ (c) $\sec x$

  (b) $\cot x$ (d) $\csc x$

Question 6. Evaluate (if possible):

  (a) $\sin\left(\dfrac{\pi}{6}\right)$ (d) $\cot(-\pi/3)$

  (b) $\cos\left(-\dfrac{3\pi}{4}\right)$ (e) $\sec\left(\dfrac{\pi}{2}\right)$

  (c) $\tan(7\pi/3)$ (f) $\csc \pi$

Question 7. Evaluate:

(a) $\tan^{-1} 1$

(c) $\sec^{-1} \sqrt{2}$

(b) $\arcsin(-\frac{1}{2})$

(d) $\arctan 0$

Question 8. Simplify:

(a) $2\sin^2 x + 2\cos^2 x - 1$

(b) $\dfrac{\sec x}{\tan x}$

Question 9. Use right triangles to solve the following:

(a) If $\tan\theta = \frac{3}{4}$ and $-\pi/2 \le \theta \le \pi/2$, find $\cos\theta$.

(b) Find an equivalent algebraic expression (so no trig functions allowed!) for $\cos(\sin^{-1} x)$.

C   Basic graphing

Question 10. Sketch the graph of each of the functions below, indicating x- and y-intercepts and asymptotes, and **write the domain and range** of each function. No calculators!

(a) $f(x) = 3x - 2$

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

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

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

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

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

(d) $f(x) = |x|$

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

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

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

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

(l) $f(x) = \tan^{-1} x$

Question 11. Use transformations to sketch the graphs of each of the following:

(a) $f(x) = -\sqrt{x}$, $f(x) = \sqrt{-x}$, $f(x) = \sqrt{x} + 2$, $f(x) = \sqrt{x+2}$, $f(x) = 2\sqrt{x}$

(b) $g(x) = -\sin x$, $g(x) = \sin(-x)$, $g(x) = \sin(2x)$, $g(x) = 2\sin x$, $g(x) = 2 + \sin x$

Question 12. Suppose
$$f(x) = \begin{cases} x^2 + 1 & \text{if } x \le 1 \\ 2x + 2 & \text{if } x > 1. \end{cases}$$

(a) Sketch the graph of $f(x)$.

(b) Find $f(-2)$, $f(1)$, and $f(5)$.

D   Exponential and Logarithmic functions

Question 13. First a review of basic exponent rules: Simplify each expression *without using a calculator*.

(a) $(-2)^4$

(b) -2^4

(c) 2^{-4}

(d) $\dfrac{3^{15}}{3^{17}}$

(e) $\left(\dfrac{2}{5}\right)^{-3}$

(f) $81^{-3/4}$

Question 14. Simplify the following:

(a) $\ln e^{\sin x}$

(b) $\log_2 \frac{1}{8}$

(c) $\ln 8 - \ln 2$

(d) $e^{x+\ln(5)}$

Question 15. If $f(x) = e^{2x} - 3e^x + 1$, find $f(0)$ and $f(\ln 2)$.

Question 16. Use properties of logarithms to expand the following into a sum, difference, and/or multiple of logarithms.

(a) $\ln\left(\dfrac{x\sin x}{\sqrt{x+2}}\right)$

(b) $\ln(e^x\sqrt{x}\cos x)^3$

E   Functions

Question 17. If $f(x) = x^2 + 4$, evaluate and simplify $\dfrac{f(2+h) - f(2)}{h}$.

Question 18. Find the domain:

(a) $g(x) = \dfrac{\sqrt[3]{x}}{x^2+1}$.

(b) $f(x) = \dfrac{\ln(x+2)}{x-1}$

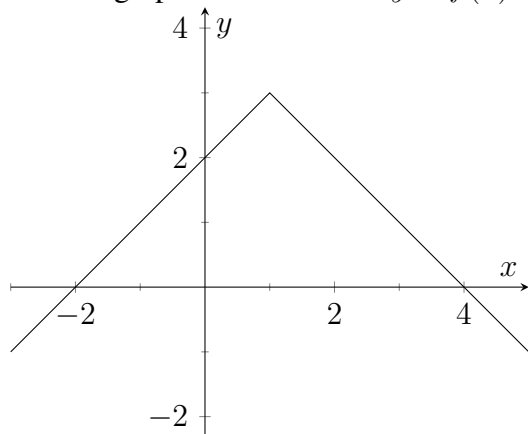(c) $h(x) = \sqrt{e^x + 1}$

Question 19. Function composition

(a) If $f(x) = x^2 + 2x$ and $g(x) = \sin x$, find $g \circ f$ and $f \circ g$.

(b) Let $h(x) = \sqrt{x^3 + 2}$. Find two functions $f(x)$ and $g(x)$ so that $h(x) = g(f(x))$. (Don't use $f(x) = x$ or $g(x) = x$.)

F   Interpreting graphs of functions

Use the graph of the function $y = f(x)$ below to answer the questions in this section.

Question 20. Find $f(1)$ and $f(-2)$.

Question 21. How many zeros does $f(x)$ have on the domain $[-3, 5]$?

Question 22. Find all solutions to the equation $f(x) = 1$ on the interval $[-3, 5]$.

Question 23. Find the range of $f(x)$ on the domain $[-3, 5]$.

Question 24. Find all values of x for which $(x, 1/2)$ is a point on the graph of $y = f(x)$.

G   Algebra skills

Question 25. Subtract:

(a) $\dfrac{1}{x} - \dfrac{1}{\sin x}$

(b) $\dfrac{1}{(x + h) + 1} - \dfrac{1}{x + 1}$

Question 26. Simplify the following:

(a) $\dfrac{x^2 + x - 6}{x + 3}$

(b) $\dfrac{x^2 \cdot \frac{1}{x} - 2x \ln x}{(x^2)^2}$

(c) $\dfrac{\frac{3}{x}}{\frac{y}{x^2}}$

Question 27. Rewrite as a product, sum, or difference using negative exponents:

(a) $\dfrac{\sin x}{x^2}$

(b) $\dfrac{1 - \sqrt{x}}{x^3}$

Question 28. Factor the following completely:

(a) $9x^2 - 16$

(b) $x^5 + 8x^2$

(c) $x^2 - x - 12$

(d) $x - x^{1/3}$

(e) $(x+1)^{-4}(3)(x+5)^2 + (-4)(x+1)^{-5}(x+5)^3$

(f) $\sin^2 x - 2\sin x + 1$

(g) $xe^x - e^x$

(h) $x\ln x + x$

Question 29. Write the following expression so that there is no root in the numerator, and then simplify.

$$\frac{\sqrt{x+h} - 1 - (\sqrt{x} - 1)}{h}$$

Question 30. Solve for z in the following and simplify:

(a) $2x + 2yz = \dfrac{x^2 \cdot 4yz - 2y^2 \cdot 2x}{(x^2)^2}$

(b) $2xy + x^2 z = e^{xy}(y + xz)$

H   Solving Equations

Question 31. Solve the following equations (Hint: Many involve using the factoring you already did in an earlier question.)

(a) $9x^2 - 16 = 0$

(b) $x^2 - x - 12 = 0$

(c) $x^2 - x = 13$

(d) $x^2 - x + 12 = 0$

(e) $x - x^{1/3} = 0$

(f) $(x+1)^{-4}(3)(x+5)^2 + (-4)(x+1)^{-5}(x+5)^3 = 0$

Question 32. Solve the following trigonometric equations:

(a) $\cos x = \frac{1}{2}$ on $[0, 2\pi]$

(b) $\sin^2 x + 1 = 2\sin x$ on $[-2\pi, 2\pi]$ (Use your factoring above)

Question 33. Solve the following equations using the factoring you already completed in an earlier question.

(a) $xe^x - e^x = 0$

(b) $x \ln x + x = 0$

I   Solving Inequalities

Question 34. Solve the following inequalities and express the answer using interval notation.

(a) $3 + 7x < 5$

(b) $-3 < 7 - 2x \leq 15$

Question 35. Solve the following inequalities and express the answer using interval notation.

(a) $x^2 \geq 2x + 3$

(b) $x^2(x - 3)(x + 5) < 0$

J   Detecting errors

For each of the following equations, determine whether it is True (i.e. true for *all* values of x and y) or False (meaning at least sometimes false).

(a) $(x + y)^2 = x^2 + y^2$

(b) $\sqrt{x^2 + 4} = x + 2$

(c) $\sqrt{4x^2} = 2x \ (x \geq 0)$

(d) $\sin(x + y) = \sin x + \sin y$

(e) $\dfrac{1}{x + y} = \dfrac{1}{x} + \dfrac{1}{y}$