

Summer 2026

Honors Precalculus Summer Packet

Welcome to Honors Precalculus! All students entering Honors Precalculus are expected to have mastered topics presented in Algebra 1, Geometry, and Algebra 2. Below is a list of the top skills for success in Precalculus, plus a diagnostic self-check for you to see what you need to practice.

If you need help understanding what something on the skills list means, need help finding extra practice, or have any other questions about the course, please email me at sbelmar@saintjohnsprep.org.

Core Algebra 2 Skills

- **Solving equations:** Linear, quadratic (by factoring, completing the square, quadratic formula), rational, absolute value, radical, exponential, and logarithmic equations.
- **Factoring fluency:** Difference of squares, sum/difference of cubes, perfect square trinomials, and grouping.
- **Exponent rules:** Simplifying expressions with positive, negative, and fractional exponents.
- **Radical manipulation:** Simplifying square roots and higher roots with variables.
- **Polynomial division:** Synthetic and long division.
- **Logarithmic properties:** Expanding, condensing, solving log equations, and transformations.
- **Complex numbers:** Operations with complex numbers, simplifying expressions involving i , and solving quadratics with complex solutions.

Functions & Their Behaviors

- **Parent function recognition:** Understanding key characteristics of linear, quadratic, absolute value, square root, cubic, cube root, exponential, logarithmic, and rational functions.
- **Function transformations:** Shifts, stretches, compressions, and reflections, both algebraically and graphically.
- **Domain and range analysis:** Recognizing restrictions from undefined values.
- **Inverse functions:** Finding and verifying inverses algebraically and graphically.
- **Operations with functions:** Addition, subtraction, multiplication, division.
- **Composition of functions:** Evaluating $f(g(x))$, domain restrictions, and one-to-one properties.
- **Piecewise functions:** Evaluating and graphing, understanding continuity.
- **Solving polynomial equations:** Finding real and complex roots using factoring, synthetic division, and Rational Root Theorem.
- **Sketching polynomial graphs:** End behavior, turning points, root multiplicity, extrema.

Geometric Foundations for Precalculus

- **Equations of circles:** Finding center and radius using completing the square.
- **Pythagorean theorem applications**
- **Parallel & perpendicular lines:** Writing equations, determining relationships, understanding point-slope, slope-intercept, and standard forms.

Trigonometry Foundations

- **Right triangle trigonometry:** Using SOH-CAH-TOA to solve missing sides and angles, including special right triangles (30° - 60° - 90° and 45° - 45° - 90°).

Recommended Resources for Algebra Skills:

Khan Academy Courses/Lessons– Algebra 1, Algebra 2 (Units on Complex Numbers, Logarithms, and Transformation of Functions), College Algebra (Units on Functions, Complex Numbers, Rational Expressions & Equations, and Advanced Function Types), Get Ready for Precalculus

Purplemath – Beginning Algebra Topics: <https://www.purplemath.com/modules/index.htm>
YouTube recommended playlists below

Recommended Resources on Functions:

Khan Academy Algebra 2 and College Algebra Courses

Desmos – Graphing Calculator: <https://www.desmos.com/calculator>

Paul's Online Math Notes – Class Notes from Algebra, Algebra Trig Review under Extras (includes rationals, exponentials, and logarithms), and How to Study Math under Extras:
<https://tutorial.math.lamar.edu/> Paul's is a goldmine for the rest of your math courses!

Recommended Resources on Trigonometry:

Khan Academy Geometry Course

Math is Fun – Trigonometry: <https://www.mathsisfun.com/algebra/trigonometry-index.html>

YouTube Mario's Math Tutoring – Playlist on Right Triangle Trigonometry

Recommended Resources on Problem Solving:

Breaking Down Word Problems: Strategies for Success: <https://mathlife.org/breaking-down-word-problems-strategies-for-success/>

Recommended Resources on the TI-84 Calculator:

TI-84 Plus CE Guidebook:

https://education.ti.com/html/eguides/graphing/84PlusCE/EN/content/eg_84ref/m_splashpage/ti-refguide_84plusce.HTML

MathBits – TI-84 Tutorials: <https://mathbits.com/MathBits/TISection/Openpage.htm>

In addition to the resources listed above, we also recommend the following websites and YouTube channels:

- Mathbitsnotebook.com (fabulous resource you should use all year!)
- The Organic Chemistry Tutor on YouTube (Playlists on Linear Equations and Slope, Algebra, Geometry, and SAT Math)
- MathAntics on YouTube (Playlists on Algebra Basics 1/2/3, Exponents, Ratio and Proportions)
- Mashup Math on YouTube (Playlists on Algebra 1; Slope and Linear Functions; Exponents, Geometry Transformations, SAT Math, Algebra II & Trig Practice)
- Mario's Math Tutoring on YouTube (Playlists on Exponents, Learn Algebra 1, Equations of Lines, Factoring-All Types; Learn Algebra 2, Absolute Value Equations & Inequalities, Imaginary and Complex Numbers, Quadratic Formula and Discriminant, Right Triangle Trig, Radicals, Polynomial Graphing, Algebra 2)

The following materials will be required for Precalculus Honors:

- Graphing calculator (TI-84 Plus or TI-84 Plus CE). If you choose to use a TI-NSpire or other graphing calculator, be aware that lessons will teach the use of the TI-84 Plus CE only.
- Two composition notebooks (at least 100 pages each, no spirals, and no vinyl/plastic covers). We will fill both notebooks!
- Double-sided tape roller (no glue or gluesticks!), scissors, and 6-inch ruler
- Graph paper and loose leaf paper
- 3-ring binder (can be shared with other subjects as long as Alg 2 has its own section). There will be handouts almost every day in addition to what we do in the composition books
- Pencils (work must be done in pencil!)
- Highlighters (2-3 colors)
- Colored pencils (at least 3-4)
- 2 colored pens (red, green, purple, pink, not blue or black) for grading your work

If you need help understanding what something on the skills list means, need help finding extra practice, or have any other questions about the course, please email me at sbelmar@saintjohnsprep.org. The self-check and the answer key for it are on the next page.

HAVE A GREAT SUMMER!

Self-check on Precalculus Readiness

Solve each problem and show all work where applicable.

1. Solve for x :

$$\frac{2x}{3} - \frac{5}{6} = \frac{1}{2}$$

2. Factor $6x^2 + 13x + 6$

3. Simplify:

$$\frac{x^3y^{-2}}{x^{-2}y^4}$$

4. Simplify:

$$\sqrt{72x^4y^3}$$

5. Divide $x^3 + 3x^2 - 4x - 12$ by $x + 2$. Perform synthetic and long division. What is the quotient?

6. Condense:

$$\log a + \log b - \log c$$

7. What is the inverse of $f(x) = 2x + 3$?

8. Evaluate $f(g(x))$ for $f(x) = x^2$ and $g(x) = x + 3$. What is $f(g(2))$?

9. What transformations of the function $f(x) = x^2$ would create:

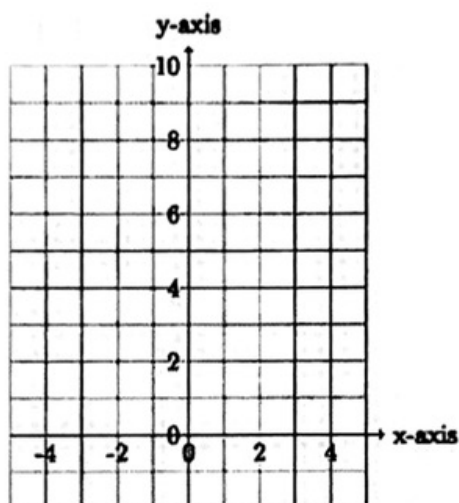
$$g(x) = -2(x - 3)^2 + 4$$

10. Multiply and simplify: $(2 + 3i)(4 - i)$

11. What is the domain of $f(x) = \frac{1}{x-2}$?

12. Graph the piecewise function:

$$f(x) = \begin{cases} x+2, & x < 0 \\ x^2, & x \geq 0 \end{cases}$$



13. What is the center of the circle:

$$(x-3)^2 + (y+4)^2 = 25$$

14. Solve for x :

$$|2x-3| = 7$$

15. In a right triangle, if:

$$\sin(\theta) = \frac{3}{5}$$

What is $\cos(\theta)$?

Self-Check Key

$$\textcircled{1} \frac{2x}{3} - \frac{5}{6} = \frac{1}{2}$$

$$\frac{4x}{6} - \frac{5}{6} = \frac{3}{6}$$

$$4x - 5 = 3$$

$$4x = 8$$

$$\boxed{x=2}$$

$$\textcircled{2} 6x^2 + 13x + 6$$

$$6x^2 + 9x + 4x + 6$$

$$3x(2x+3) + 2(2x+3)$$

$$\boxed{(3x+2)(2x+3)}$$

$$\textcircled{3} \frac{x^3 y^{-2}}{x^{-2} y^4}$$

$$\frac{x^3 x^2}{y^4 y^2} = \boxed{\frac{x^5}{y^6}}$$

$$\textcircled{4} \sqrt{72x^4 y^3} \quad 72 = 36 \cdot 2$$

$$\boxed{6x^2 y \sqrt{2y}}$$

$$\textcircled{5} x^3 + 3x^2 - 4x - 12 \div x + 2$$

$$\begin{array}{r} x^2 + x - 6 \\ x+2 \overline{) x^3 + 3x^2 - 4x - 12} \\ \underline{-x^3 - 2x^2} \downarrow \\ x^2 - 4x \downarrow \\ \underline{-x^2 - 2x} \downarrow \\ -6x - 12 \downarrow \\ \underline{-6x - 12} \\ 0 \end{array}$$

$$\begin{array}{r} -2 \overline{) 1 \quad 3 \quad -4 \quad -12} \\ \underline{ -2 \quad -2 \quad 12} \\ 1 \quad 1 \quad -6 \quad \underline{0} \end{array}$$

$$\boxed{x^2 + x - 6}$$

$$\textcircled{6} \log a + \log b - \log c$$

$$\frac{\log(ab) - \log c}{\log\left(\frac{ab}{c}\right)}$$

$$\textcircled{7} f(x) = 2x + 3$$

$$x = 2y + 3$$

$$2y = x - 3$$

$$y = \frac{x-3}{2}$$

$$\boxed{f^{-1}(x) = \frac{x-3}{2}}$$

$$(8) f(x) = x^2 \quad g(x) = x+3$$

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

$$f(g(2)) = \boxed{25}$$

or

$$g(2) = 5$$

$$f(5) = 25$$

$$(9) x^2 \rightarrow -2(x-3)^2 + 4$$

Translated up 4

Translated right 2

Reflected over the x-axis

Vertical stretch by a factor of 2

$$(10) (2+3i)(4-i)$$

$$8 - 2i + 12i - 3i^2$$

$$8 + 10i - 3i^2$$

$$8 + 10i - 3(-1)$$

$$8 + 10i + 3$$

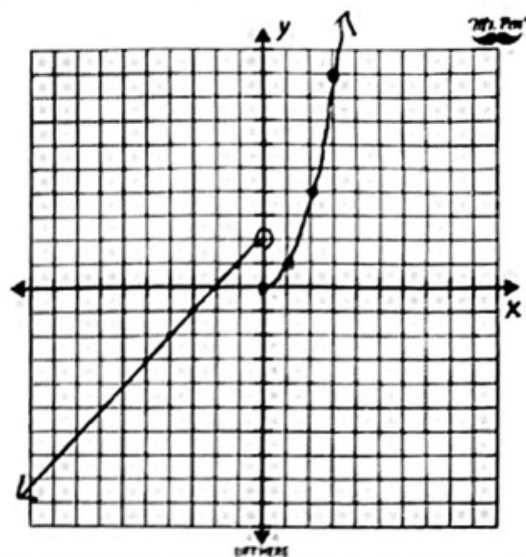
$$\boxed{11 + 10i}$$

$$(11) f(x) = \frac{1}{x-2}$$

$$x \neq 2$$

$$\text{Domain } (-\infty, 2) \cup (2, \infty)$$

$$(12) f(x) = \begin{cases} x+2; & x < 0 \\ x^2; & x \geq 0 \end{cases}$$



$$(13) (x-3)^2 + (y+4)^2 = 25$$

$$\text{center } (3, -4); r = 5$$

$$(14) |2x-3| = 7$$

$$2x-3 = 7$$

$$2x = 10$$

$$\boxed{x = 5}$$

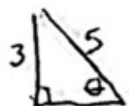
$$2x-3 = -7$$

$$2x = -4$$

$$\boxed{x = -2}$$

$$\boxed{x = \{-2, 5\}}$$

$$(15) \sin \theta = \frac{3}{5}$$



3-4-5 Triangle

$$\cos \theta = \frac{4}{5}$$