Summer Assignment for AICE High Math I

This summer assignment is designed to help you maintain your skills in preparation for AICE High Math I. Nothing on this assignment is new, and your mastery of these topics is essential for success in this course. It is imperative that you understand how to complete each problem on your own.

****Neatly show all work and your solution for each problem on SEPARATE PAPER.****

Only scientific calculators are allowed, so the reliance on any graphing calculator (including Desmos) is strongly discouraged. When exact answers are called for, your solutions should not contain decimals.

You will have a quiz on this material on the first day of class.

This assignment and all associated work is due on or before August 27, 2026.

If additional help/review is needed, it is recommended that you go online to Khan Academy – Specifically Algebra 2, Trigonometry, Geometry and Physics topics may be helpful (key words to search are provided in each section).

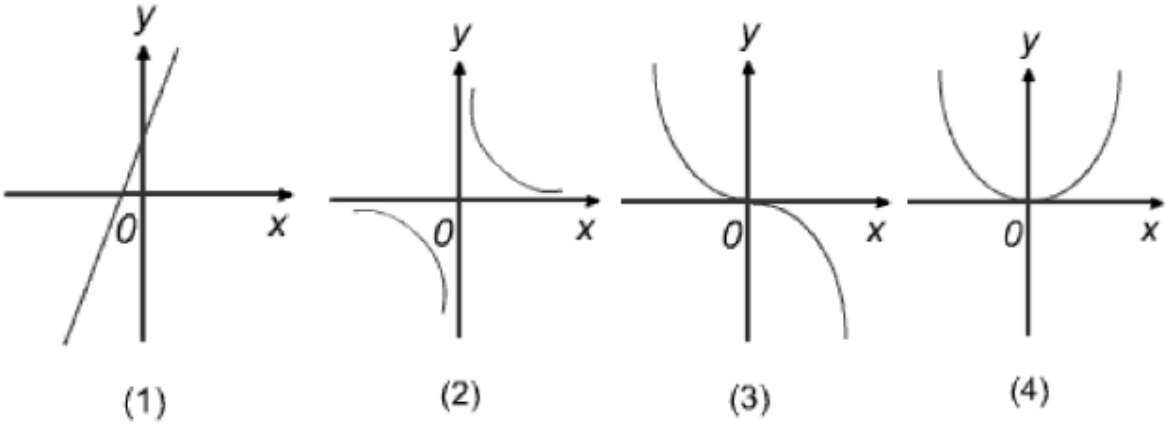
Algebra and Functions

1. **Factor completely** (Key word – Factoring):
   a. $4x^2 - 25$
   b. $x^2 + 7x + 6$
   c. $x^3 - 8$
   d. $x^3 + 8$
   e. $27x^3 - 125y^3$
   f. $x^4 + 11x^2 - 80$
   g. $x^3 - xy^2 + x^2y - y^3$
   h. $3x^2 - 2x - 5$
2. **Solve for *x*** (Key word – Solving Quadratics):
   a. $\frac{1}{x^4} - \frac{7}{x^2} + 10 = 0$
   b. $x - 3x^{\frac{1}{2}} + 2 = 0$
   c. $2x + 5\sqrt{x} - 12 = 0$
   d. $\frac{1}{(x^2-4)^2} - \frac{1}{x^2-4} - 20 = 0$
   e. $8x^4 - 4x^2 = 0$
   f. $3x^{\frac{2}{3}} - x^{\frac{1}{3}} - 4 = 0$
3. **Use the discriminant of the quadratic equation to answer the following question (**Key word – Discriminant)
   a. How many roots do the following quadratics have?
      i. $x^2 - 4x - 7$
      ii. $3x^2 + 5x + 1$
      iii. $2 + x - x^2$
      iv. $7 + 2x - 5x^2$
4. **Find the point(s) of intersection of the following lines and curves**. Show all algebra used. Remember : Do not rely on graphing calculators (including Desmos). (Key word – Nonlinear Systems)
   a. $\begin{cases} x - y = 2 \\ 2x^2 - 3y^2 = 15 \end{cases}$
   b. $\begin{cases} 2x - y = 1 \\ 3x^2 - y^2 = 3 \end{cases}$
   c. $\begin{cases} 4x + y = 2 \\ 4x + y^2 = 8 \end{cases}$
   d. $\begin{cases} x + y = 1 \\ x^2 - xy = 15 \end{cases}$
   e. $\begin{cases} xy + x = -3 \\ 2x + 5y = 8 \end{cases}$

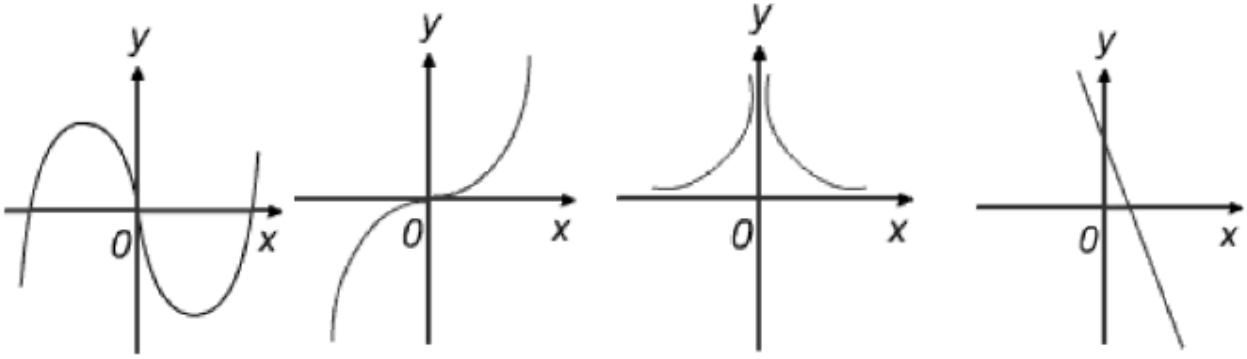
5. Simplify (write all final answers with positive exponents and roots as applicable) (Key word – Exponent Rules):
   a. $5^4 \times 5^3$
   b. $(3^2)^4$
   c. $-3x^{-3}$
   d. $-5\left(\frac{3}{2}\right)(4-9x)^{-\frac{1}{2}}(-9)$
   e. $2\left(\frac{2}{2-x}\right)\left(\frac{-2}{(2-x)^2}\right)$
   f. $(16x^2y)^{\frac{3}{4}}$
   g. $\frac{\sqrt{4x-16}}{\sqrt{(x-4)^2}}$
   h. $-4\left(\frac{2x-1}{2x+1}\right)^{-3}\left[\frac{2(2x+1)-2(2x-1)}{(2x+1)^2}\right]$
   i. $\frac{\frac{1}{2}(2x+5)^{-\frac{3}{2}}}{\frac{3}{2}}$

6. Solve the following inequalities (Key word – Absolute value inequalities):
   a. $|x-3| > 12$
   b. $|x-3| \leq 4$
   c. $|10x+8| > 2$
   d. $|3x-4| \geq -2$
   e. $|x-6| < -8$

7. The graphs of eight functions are sketched below. Match the graphs with the appropriate equation. (Key word: Parent Functions)
   a. $y = 5-3x$
   b. $y = \frac{12}{x}$
   c. $y = 2x^3$
   d. $y = 4+2x$
   e. $y = -3x^3$
   f. $y = \frac{2}{x^2}$
   g. $y = x^3 + x^2 - 12x$



(1) (2) (3) (4)



(5) (6) (7) (8)

8. Simplify completely (Key word – Complex Fractions):

a. $\dfrac{\frac{1}{x}+4}{\frac{1}{x}-2}$

b. $\dfrac{x-\frac{1}{x}}{x+\frac{1}{x}}$

c. $\dfrac{\frac{3}{x}-\frac{4}{y}}{\frac{4}{x}-\frac{3}{y}}$

d. $\dfrac{1-\frac{2}{3x}}{x-\frac{4}{9x}}$

e. $\dfrac{\frac{x^2-y^2}{xy}}{\frac{x+y}{y}}$

f. $\dfrac{x^{-3}-x}{x^{-2}-1}$

g. $\dfrac{\frac{2}{1-x}+\frac{1+x}{x}}{\frac{1-x}{x}+\frac{x}{1+x}}$

h. $\dfrac{\frac{4}{x-5}+\frac{2}{x+2}}{\frac{2x}{x^2-3x-10}+3}$

Key Words for #9 & 10 – Distance, Midpoint, Slope, Perpendicular Bisector

9. Let P(-3, 1) and Q(5, 6) be two points in the coordinate plane.
   a. Find the distance between P and Q.
   b. Find the midpoint of the segment PQ.
   c. Find the slope of the line that contains P and Q.
   d. Find the equation of the perpendicular bisector of the line that contains P and Q.
10. The points A(-2, 4) and B(3, 10) exist in the coordinate plane.
   a. Find the distance between A and B.
   b. Find the midpoint of the segment AB.
   c. Find the slope of the line that contains A and B.
   d. Find the equation of the perpendicular bisector of the line that contains A and B.
11. If $f(x) = x^2 + 1$ and $g(x) = x - 3$, find and ***simplify*** the following. (Key word: Composition)
   a. $f(g(x))$
   b. $g(f(x))$
   c. $f(g(2))$
   d. $g(f(2))$
   e. $g(g(g(x)))$
12. If $f(x) = x^2 - 1$, describe, ***in words***, what the following operations would do to the graph of $f(x)$: (Key word – Transformations)
   a. $f(x) - 4$
   b. $f(x - 4)$
   c. $-f(x + 2)$
   d. $5f(x) + 3$
   e. $f(2x)$
   f. $|f(x)|$

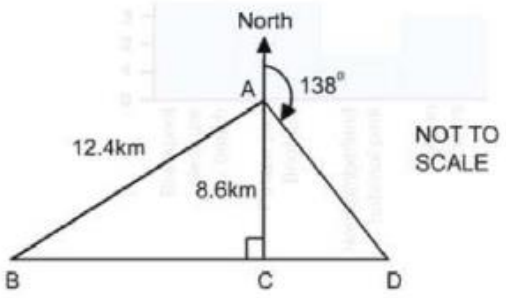
Key word for #13-19: Sequences

13. Write down the expression to find the nth term for each of the following sequences.
   a. 2, 5, 10, 17, 26, 37, …
   b. 4, 16, 36, 64, 100, 144, …
14. Find the first six terms and the sixth partial sum of the sequence whose nth term is $a_n = 2n^2 - n$

15. An arithmetic sequence begins 2, 5, 8, 11, 14, …
    a. Find the common difference, *d*
    b. Find the formula for the n^{th} term of the sequence
    c. <u>Use your formula</u> to find the 35^{th} term of the sequence.
16. A geometric sequence begins $12, 3, {}^{3}/_{4}, {}^{3}/_{16}, {}^{3}/_{64}, \ldots$
    a. Find the common ratio, *r*
    b. Find the formula for the n^{th} term of the sequence
    c. <u>Use your formula</u> to find the 10^{th} term of the sequence.
17. The first term of a geometric sequence is 25 and the fourth term is 0.2.
    a. Find the common ratio, *r*, and the fifth term.
    b. Find the partial sum of the first eight terms.
18. The first term of an arithmetic sequence is 10 and the tenth term is 2.
    a. Find the common difference, *d*, and the 100^{th} term of the sequence.
    b. Find the partial sum of the first ten terms.

<u>Trigonometry</u> <u>(Khan Academy has an entire course called "Trigonometry")</u>

19. The diagram shows the position of points A, B, C and D. A is due North of C. The straight line BCD is perpendicular to AC. A is 12.4 km from B and 8.5 km from C.



    a. Calculate the distance BC.
    b. The bearing of D from A is 138°. Calculate the distance DC.
20. If $\cos\theta = {}^{5}/_{13}$, and Θ is in quadrant II, find sin Θ and tan Θ
21. If $\cot\theta = 3$ and Θ is in quadrant III, find sin Θ and cos Θ
22. Find the *<u>exact</u>* value of the following **WITHOUT A CALCULATOR!!!!! Hint: Use Unit Circle**
    a. $\sin^2 225° - \cos^2 225°$
    b. $(6\sec 180° - 4\cot 90°)^2$
    c. $(4\cos 30° - 6\sin 120°)^{-2}$

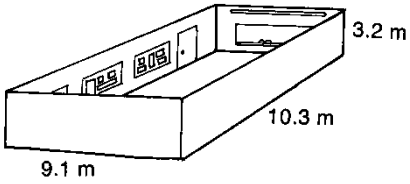
23. Solve the following triangles completely accurate to 3 decimal places. (Drawing a picture always helps.)
    a. B = 16°, C = 90°, a = 21.7 cm
    b. C = 92°, a = 6 ft, c = 95 in

24. Solve each equation on the interval [0, 2π) **WITHOUT A CALCULATOR (Use Unit Circle)**. Report exact answers when possible. (Note: don't divide by a trig function or you will lose valid solutions)
    a. $\sin x = \frac{1}{2}$
    b. $\cos^2 x = \cos x$
    c. $2\cos x + \sqrt{3} = 0$
    d. $4\sin^2 x = 1$
    e. $2\sin^2 x + \sin x = 1$
    f. $\cos^2 x + 2\cos x = 3$
    g. $2\sin x \cos x + \sin x = 0$
    h. $\sin^2 x - \cos^2 x = 0$
    i. $8\cos^2 x - 2\cos x = 1$ (you can use a calculator to finish this one)

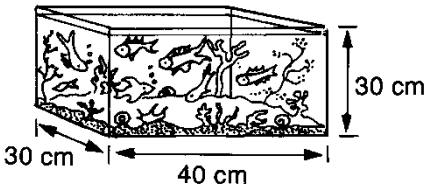
25. Verify each identity:
    a. $\tan\theta \sin\theta + \cos\theta = \sec\theta$
    b. $\frac{\tan\theta}{1-\cos\theta} = \csc\theta\,(1 + \sec\theta)$
    c. $\frac{1+\sin x}{\cos x} + \frac{\cos x}{1+\sin x} = \frac{2}{\cos x}$

Geometry – Key words: Area, volume, surface area

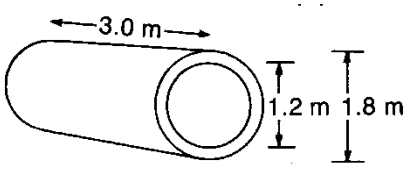
26. A classroom has the dimensions shown. Find:
    a. the area of the floor
    b. the volume of the room
    c. the total area of the four walls.



27. If one guppy requires 5 L of water to live happily, what is the maximum number of guppies that should be kept in this aquarium?



28. A section of concrete pipe 30 m long has an inside diameter of 1.2 m and an outside diameter of 1.8 m. What is the volume of concrete in this section of pipe?



29. A cereal company decided to make an odd-shaped box for a promotion they are doing. The new design is a rectangular prism with a length of 10 in, width of 8 in., and height of 4 in. and attached to the rectangular prism is a cylinder with a radius of 2 in. and a height of 10 in. How much cereal will fit in the box?

Mechanics

Calculate displacement (distance from start), velocity, and acceleration using the following formulas. *Note: displacement is in meters, velocity is in m/s, and acceleration is m/s^2.*

When velocity is constant ⟶ Displacement = velocity × time

When acceleration is constant ⟶ Velocity = acceleration × time

30. Find the time taken for a particle traveling
    a. 30 m at a velocity of 5 m/s
    b. 8 m at a velocity of 0.2 m/s
    c. 5 m at a velocity of 25 m/s
31. Find the displacement of a particle travelling with
    a. A velocity of 12 m/s for 12 seconds
    b. A velocity of 0.4 m/s for 10 seconds
    c. A velocity of 30 m/s for 0.5 seconds
32. Find the velocity of a particle that has
    a. A displacement of 24 m in 8 seconds
    b. A displacement of 45 m in 30 seconds
    c. A displacement of 10 m in 50 seconds
33. Find the change in velocity when a particle accelerates at
    a. 10m/s^2 for 10 seconds
    b. 0.2 m/s^2 for 30 seconds
34. Find the acceleration when a particle's velocity changes
    a. From 20 m/s to 50 m/s in 10 seconds
    b. From 44 m/s to 43 m/s in 6 seconds
35. Find the time taken for a particle to accelerate from 15 m/s to 60 m/s at 15 m/s^2.