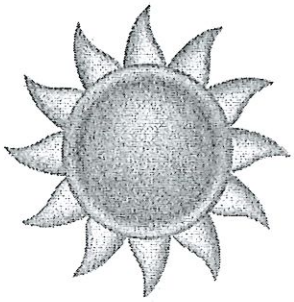
Pre-Calculus



Dear Students,

Happy summer vacation!! The math department at Atlantis Charter High School wants you to be a successful mathematician this upcoming school year. This summer packet is designed to help you reach these goals by reviewing necessary skills for your upcoming course.

If you are confused on a topic, leaving that section blank is not acceptable. It is your responsibility to go online and find some resources that will help you, as these should be review topics. A very helpful resource is www.khanacademy.org. This website has videos and tutorials on all math topics, with quizzes to check your understanding.

- This math packet is due when you return back from summer vacation
- Work must be shown to receive full credit (No work – no credit)
- Every problem must be completed
- This will count as a test grade
- You may have a quiz on the topics in this packet during the first week of school

Please take your time through this packet, pace yourself throughout the summer (do not leave it until the day before school!). Have fun!

Do your best!

Sincerely,

Your future math teacher

Precalculus Summer Packet:

Entering into Precalculus means entering into your first year of college preparatory mathematics. There is a major shift in expectation for students to be able to recall many skills at a moment's notice. Certain concepts that have been taught to you over the previous years are assumed to be mastered. If you do not have these skills, you will find that you will consistently get problems incorrect next year as you make mistakes. It is frustrating for students who spend much of their homework time relearning algebra concepts in addition to learning how to tie the concepts together. This summer packet is intended for you to brush up and possibly relearn these topics.

On the following pages, you have assorted problems related to specific topics. Each problem should be done in the space provided. Rather than give you a textbook to remind you of the formulas and techniques necessary to solve the problem, there are a few websites listed that have full instructions on the techniques. If and when you are unsure of how to attempt these problems, use these websites. Don't fake your way through these problems. You are only setting yourself up for a future struggle.

Realize also that many concepts are interrelated. This will be the focus throughout next year as we examine the mathematical relationships between topics numerically, algebraically and graphically. While you may be strong in one of these approaches, you must learn to view each topic from the other two approaches as well to achieve full understanding. Success on your tests and quizzes throughout the year will depend on you being able to do so.

You need to get off to a good start so spend some quality time on this packet this summer. Tear off this first page and return the remaining sheets stapled together. Be sure your name appears on the first sheet. Work needs to be shown when needed. Also, do not rely on the calculator to work through the majority of these problems. You will be tested without the calculator, so practice without the calculator.

This packet is to be completed by the first day back in school in the fall. You will be tested on this material within the first two weeks of school. You will also be expected to efficiently work through the problems under a time constraint. Many students are not prepared for this expectation and find they do not have the time to check their answers like they are used to. Prepare accordingly.

It is a mistake to decide to do this now. Let it go until mid-summer. We want these techniques to be relatively fresh in your mind in the fall. But, do not wait to do them at the very last minute. These take time. If you do a few concepts a day, the whole packet will take you about a week to complete.

We hope you take this seriously as we sincerely wish for you to be successful throughout this next year. Your preparation over the summer will be rewarded in unexpected ways during the year.

Good Luck!

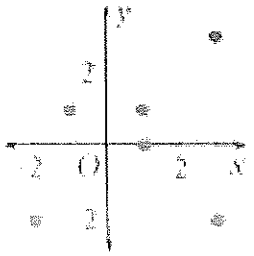
Note: Should you have any questions regarding this packet over the summer Mr. Fonseca will be available to answer your questions by email at Nicholas.fonseca@atlantiscs.org. When you ask your question, please let me know what steps you have taken on your own so I may give you better guidance to solve that problem. The internet can also be a great resource. Websites like khanacademy.org, purplemath.com, and sosmath.com offer tutorial on these topics. When in doubt, try searching the topic in Google.

State whether the relation is a function. Write yes or no. State the domain and range of each function.

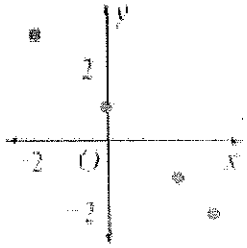
5. $\{(-1,2),\ (3,10),\ (-2,20),\ (3,11)\}$

6. $\{(0,2),\ (13,6),\ (2,2),\ (3,1)\}$

5.



6.



14: Function Notation

Given $f(x)=-x^2+x$, answer the following questions.

1. Find $f(0)$

2. Find $f(x)=0$

3. Find $f\left(-\frac{1}{3}\right)$

Given $f(x)=\frac{1}{3}x+\frac{7}{4}$, answer the following questions.

4. Find the zeros of $f(x)$

5. Solve $f(x)=\frac{1}{8}$

6. Find $f\left(-\frac{9}{8}\right)$

Find the following values for each given function.

3. $f(x)=-2x^2+x-1$

a. $f(0)=$

b. $f(-1)=$

c. $f(-x)=$

d. $-f(x)=$

e. $f(x+1)=$

f. $f(2x)=$

4. $f(x)=\frac{x^2-1}{x+4}$

a. $f(0)=$

b $f(-1)=$

c. $f(-x)=$

d. $-f(x)=$

e. $f(x+1)=$

f. $f(2x)=$

Function Operations:

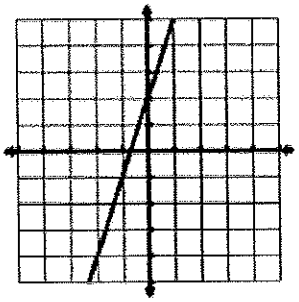
Perform the indicated operation.	
32. $g(a) = 4a + 3$ $f(a) = 3a - 4$ *Find* $(g - f)(a)$	*33.* $h(x) = 2x - 3$ $g(x) = -2x^3 + 4$ *Find* $(h \cdot g)(x)$
34. $g(a) = 4a + 3$ $f(a) = 3a - 4$ *Find* $(f - g)(a)$	*35.* $h(x) = 2x - 3$ $g(x) = x^2 + 5x - 1$ *Find* $(g \cdot h)(x)$

Domain & Range Review

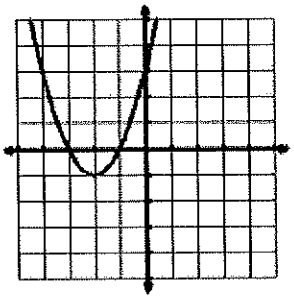
Domain: The possible x-values of a function *Range:* The possible y-values of a function

Give the domain and range of the following.

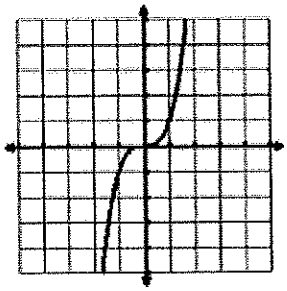
Example:
Domain: All real numbers
Range: All real numbers



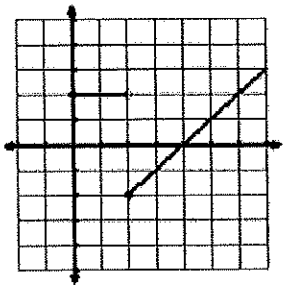
70. D: _____
R: _____



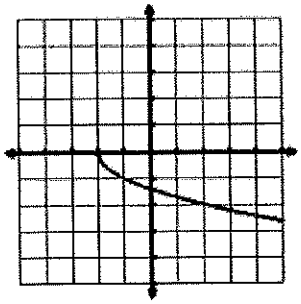
71. D: _____
R: _____



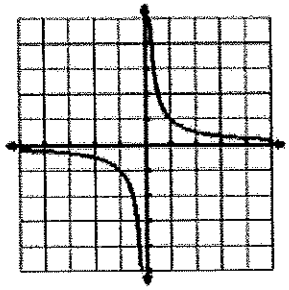
72. D: _____
R: _____



73. D: _____
R: _____



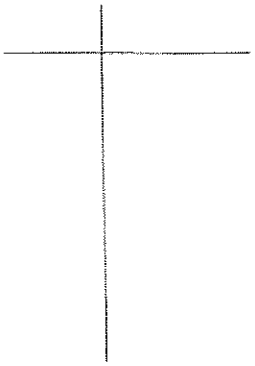
74. D: _____
R: _____

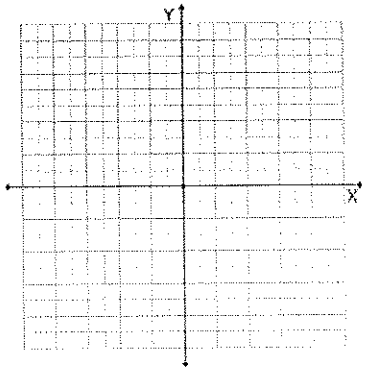


Part 3: Graphing equations using T-chart

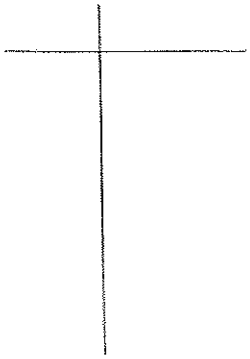
Graph each function without using a calculator. Create a T chart, select 5-10 x-values and determine the y-value. Use these coordinates to plot the graphs

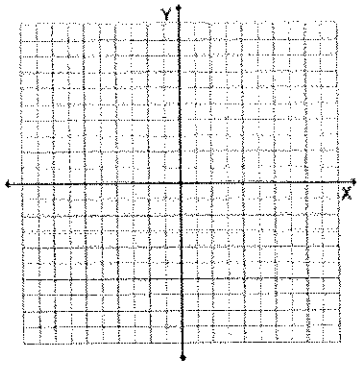
5. $y = -\frac{1}{2}x - 3$



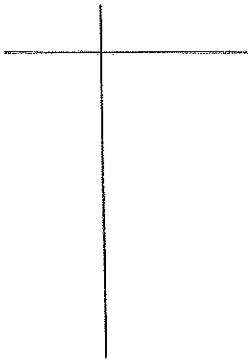


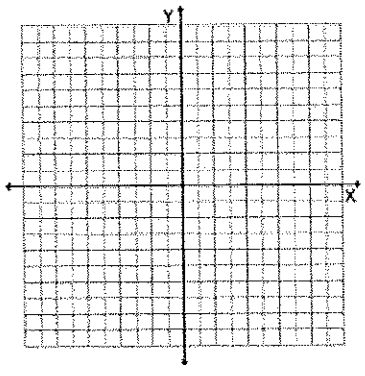
6. $3xy = 1$





7. $y = x^2 - x - 6$





19: Basic Graphing Choosing "Smart" Points

Fill in the T-chart using at least 3 smart x-values (that enable you to find exact points)

1. $f(x)=\sqrt{3-x}$

2. $f(x)=\dfrac{7}{x-2}$

3. $f(x)=3^{\frac{x}{4}}$

4: Factoring by GCF

Factor the following completely

1. $3x^4-9x^2$
2. $49xy+28x-14y$
3. $18x^3y^5-12x^4y^2$

5: Factoring Quadratic Expressions

Factor the following completely

1. x^2-3x+2
2. x^2+5x-6
3. $2x^2+5x-3$
4. $3x^2-8x+4$
5. $3x^2+17x+10$
6. $10x^2-19x+6$

6: Special Factoring

$$a^2+2ab+b^2=(a+b)^2 \qquad a^3+b^3=(a+b)(a^2-ab+b^2)$$
$$a^2-2ab+b^2=(a-b)^2 \qquad a^3-b^3=(a-b)(a^3+ab+b^2)$$
$$a^2-b^2=(a+b)(a-b)$$

Factor the following completely

1. $4x^2-20x+25$
2. $49x^2+42xy+9y^2$
3. $16x^4-81$
4. x^3-8
5. $125x^3+y^3$
6. $64-27y^6$

Part 4: Factoring

Use a method to factor the expressions below completely over the set of real numbers. If it is not factorable, write "prime." Methods for factoring include AC Method (breaking up the middle term), Factor by grouping, Difference of Squares, Perfect Square Trinomials, and Greatest Common Factor.

8) $3p^6 - 7p^3 - 6$

9) $12m^2 - 6m$

10) $12a^2b + 18ab^3 - 24a^3b^2$

11) $x^2 + 10xy + 16y^2$

12) $4x + 4y + mx + my$

13) $x^4 + 13x^2 + 42$

14) $9p^2 - 49$

15) $16z^2 - 121$

16) $25x^2 + 1$

17) $16v^4 - 81$

18) $r^2 + 15r + 54$

19) $36r^2 - 6r - 20$

7: Factoring through Synthetic Division

Use synthetic division to factor as indicated.

1. $x^3 - 4x^2 + 2x + 1 = (x - 1)(\quad)$

2. $2x^3 + 5x + 7 = (x + 1)(\quad)$

3. $x^4 - 3x^3 + x^2 + x + 2 = (x - 2)(\quad)$

4. $4x^4 + 3x^2 - 1 = (2x - 1)(\quad)$

Solve the following quadratic equations by using Square Roots.		
15. $9x^2 - 10 = 215$	*16. $10 - 8x^2 = -302$*	*17. $5a^2 + 10 = -12$*

9: Solving Quadratic Equations by Factoring
Factor to solve for x.

1. $x^2+5x+6=0$ 2. $8x^2-6x-5=0$ 3. $11x^2-14x-16=0$

10: Solving Quadratic Equations using the Quadratic Formula
For each equation, solve for the indicated expression.

1. $2x^2-4x-1=0$ *for* x 2. $2x^2+2x+3=0$ *for* x 3. $x^4-4x^2+2=0$ *for* x^2

Part 5: Solving simple quadratics

20. Solve for x in each question – find exact values (no decimals).

a. $2x^2-18=0$ b. $x^2-x+38=45-x$ c. $27-x^2=54$

21. Solve for the variable.

a. $x^2+5x+6=0$ b. $x^2=2x+15$

22. Solve for the variable.

a. $8x^2-6x=5$ b. $x^2+49=-14x$

26. Simplify each of the following without a calculator.

a. $(-2^2)^3$ b. $-\left(\frac{2}{5}\right)^{-2}$ c. $\left(3x^2y\right)^{-3}$ d. $\frac{y^{-4}}{5x^{-2}}$ e. $\left(\frac{356x^4y^{-3}z}{34x^{-14}y^4}\right)^0$

5. $\frac{x^{-1}y}{xy^{-2}}$ 6. $\frac{3xy^9}{2y^{-2}}\cdot\frac{-7y}{42x^5}$

2: Fractional Exponents

Evaluate the following without a calculator

1. $8^{\frac{2}{3}}$
2. $4^{-\frac{1}{2}}$
3. $\left(\sqrt[4]{16}\right)^2$
4. $\sqrt[3]{1000^2}$
5. $\left(\sqrt[3]{-27}\right)^4$
6. $-(25^{-\frac{3}{2}})$

27. Simplify each of the following without a calculator. Express your answer in lowest terms.

a. $\sqrt{32}$ b. $\sqrt{(2x)^8}$ c. $\sqrt[3]{-64}$ d. $\sqrt{80}$ e. $\sqrt[4]{32}$

f. $\sqrt{2x^2}$ g. $\sqrt{16x^3y^4}$ h. $\sqrt{20x^4y}$ i. $\sqrt{128x^6y^8z}$

28. Simplify and rationalize any denominators.

a. $\frac{4}{\sqrt{3}}$ b. $\frac{\sqrt{3}+x}{x-\sqrt{3}}$ c. $\frac{5x}{\sqrt{3x-2}}$

Simplify:

40. $(5-3i)(2+4i)$

41. $\frac{(4-5i)}{(9+i)}$

$(3-2i)(7-5i)$

$\frac{(9-2i)}{(2-4i)}$

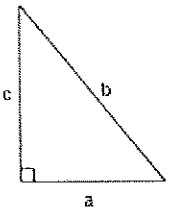
3: Simplifying Radicals

Simplify and rationalize the following.

1. $\sqrt{80}$
2. $\sqrt[4]{32}$
3. $\sqrt[3]{54x^3}$
4. $\frac{3}{\sqrt{8}}$
5. $\sqrt{\frac{4}{75}}$
6. $4\sqrt{3}\cdot\sqrt{21}$

23: Pythagorean Theorem

Use the diagram at the right to answer the following questions. Be sure to simplify.



1. Find b if $a = 4\sqrt{5}$, $c = 2$
2. Find c if $a = 2\sqrt{3}$, $b=6$
3. If a = c, and b = 10, find a

20: Distance and Midpoint Formulas

Find the distance between the two points. Then find the midpoint between the two points.

1. $(-2,5);\ (6,-1)$
2. $\left(\frac{3}{2},-\frac{1}{2}\right);\ \left(-\frac{3}{2},\frac{7}{2}\right)$
3. $\left(\frac{5}{2},-\frac{3}{2}\right);\ (1,-4)$

21: Intercepts

Use the following equations to find the x and y intercept(s)

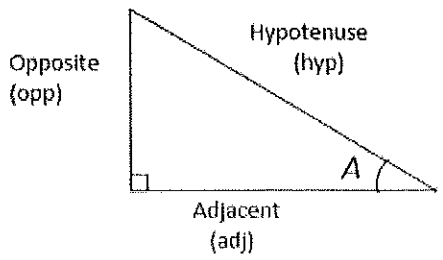
1. $y^2 = x+9$
2. $9x^2+4y^2=36$
3. $\left(\frac{x+4}{2}\right)^2+y^2=1$

22: Equations of Lines

Find the equation of the line that has the given characteristics. Leave your answer in the form indicated.

1. $slope=\frac{3}{4};\ y-\text{int}:-\frac{2}{3}$ (Standard Form)
2. Parallel to $2x+3y=4$ through $(-3,6)$ (Slope-intercept form)
3. Perpendicular to $4x-7y=23$ through $\left(\frac{2}{3},-\frac{4}{5}\right)$ (Point-Slope Form)

Basic Trigonometry Review: SOH-CAH-TOA

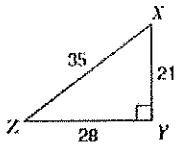


$$\sin A = \frac{opp}{hyp}$$

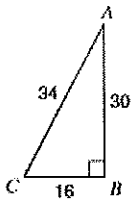
$$\cos A = \frac{adj}{hyp}$$

$$\tan A = \frac{opp}{adj}$$

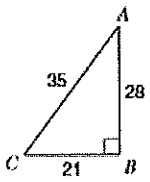
1) tan Z



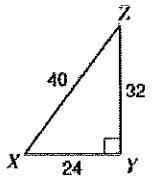
2) cos C



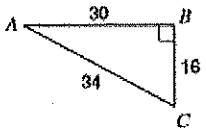
3) sin C



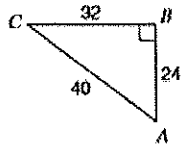
4) tan X



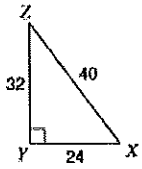
5) cos A



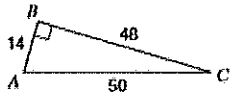
6) sin A



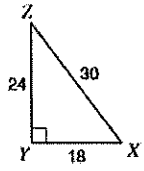
7) sin Z



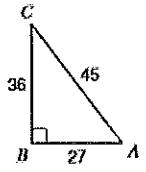
8) sin C



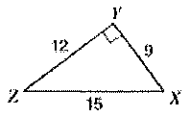
9) cos Z



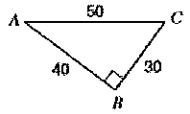
10) tan C

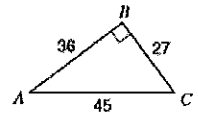


11) cos Z

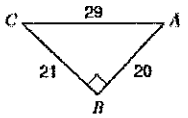


13) tan C

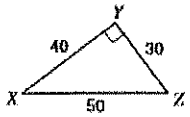
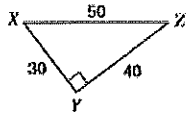




14) tan A



16) tan X



18) sin Z