Meet 5

EVENT 1: Algebra II – Complex Numbers

Notes: (1) All answers should be expressed in simplest rectangular form
(2) Refer to "Guidelines for Forms of Answers" Part A for simplification
Acceptable: $2+3i$, 0, $6i$
Not acceptable: $4+0i$, $0-2i$

Include: (1) All operations of complex numbers: addition, subtraction, multiplication, division, finding square roots, reciprocals, and absolute values
(2) Equations of degree ≥ 2 with real coefficients

Exclude: (1) Trigonometry
(2) Vectors

Sample Problems:

A. If $a=6+3i$ and $b=-3-2i$, find z if $b+ai=zi$.
Answer: $4+6i$

B. Find the reciprocal of z if $z=\frac{2}{5}+\frac{\sqrt{3}}{3}i$.
Answer: $\frac{30}{37}-\frac{25\sqrt{3}}{37}i$

C. Find z: $(3-i)z+2-2i=-6i$
Answer: $-\frac{1}{5}-\frac{7}{5}i$

Name _____ Score _____ School _____

Event 1: ALGEBRA II — Complex Numbers

February 2018

A. Simplify $\dfrac{-3i}{2-3i}$. Express your answer in the form $a+bi$.

(2 pts)

ANSWER: _____

B. Simplify $\left(\dfrac{1}{2}-\dfrac{1}{2}i\right)^5$. Express your answer in the form $a+bi$.

(3 pts)

ANSWER: _____

C. Solve for z: $|8-6i|z+(8-6i)z=(8-6i)^2$. Express your answer in the form $a+bi$.

(5 pts)

ANSWER: _____

Name _____ Score _____ School _____

Event 1: ALGEBRA II — Complex Numbers (No Trigonometry or Vectors)

February 2017

A. Simplify: $\frac{3}{3-2i}+\frac{3}{2}$. Express your answer in $a+bi$ form.

(2 pts)

ANSWER: _____

B. Simplify: $\frac{4i^{27}+3i^{125}-2i^{28}}{6+2i^{53}-5i^{81}}$. Express your answer in $a+bi$ form.

(3 pts)

ANSWER: _____

C. Given: $z=9+bi$

(5 pts) b is a positive real number

the imaginary parts of z^2 and z^3 are equal

Find: b

ANSWER: _____ $b=$ _____

Name _____ Score _____ School _____

Event 1: ALGEBRA II — Complex Numbers

February 2016

A. Find the conjugate of $\frac{3-2i}{1+3i}$. Express your answer in the form $a+bi$.

(2 pts)

ANSWER: _____

B. Simplify $\frac{5i^{22}-3i^{15}}{7i^{70}+2i^{201}}$. Express your answer in the form $a+bi$.

(3 pts)

ANSWER: _____

C. Let z be a complex number with real part 15. Let $z+n=3z-\bar{z}n-\bar{z}+3i$. Solve for n where n is a real number.

(5 pts)

ANSWER: _____ $n=$ _____

Name _____ Score _____ School _____

Event 1: ALGEBRA II — Complex Numbers (No Trigonometry or Vectors)

February 2015

A. (2 pts) Given $z - 4zi = 3 + 2i$. Find $\bar{z}$ in the form $a + bi$.

ANSWER: _____

B. (3 pts) Find the square roots of $21 - 20i$.

ANSWER: _____

C. (5 pts) Simplify: $\dfrac{(1+i)^{2015}}{(1-i)^{2016}}$

ANSWER: _____

Name _____ Score _____ School _____

Event 1: ALGEBRA II — Complex Numbers (No Trigonometry or Vectors)

February 2014

A. (2 pts) Simplify: $\frac{1}{1+i}+\frac{1}{1-i}$

ANSWER: _____

B. (3 pts) A complex number $a+bi$ has absolute value $\sqrt{65}$. a is 3 less than b. Find all such complex numbers.

ANSWER: _____

C. (5 pts) Solve for z: $z^2+13=4\bar{z}$

ANSWER: _____ $z=$ _____

Name _____ Score _____ School _____

Event 1: ALGEBRA II — Complex Numbers (No Trigonometry or Vectors)

February 2013

A. (2 pts) Given $3-4i+zi=6+i$. Find $\overline{z}$ in the form $a+bi$.

ANSWER: _____

B. (3 pts) Given $(5+5i)^{40}=r^n$ where r and n are natural numbers. Determine the smallest possible value of the sum $r+n$.

ANSWER: _____

C. (5 pts) $\left(\sqrt{2}+i\sqrt{3}\right)^{600}\left(\sqrt{2}-i\sqrt{3}\right)^{600}$ may be expressed as A^B in many ways, where A and B are positive integers. If A is the largest possible 3-digit integer, determine the ordered pair (A,B).

ANSWER: ____(_____,_____)____

Name _____ Score _____ School _____

Event 1: ALGEBRA II — Complex Numbers (No Trigonometry or Vectors) 2012

A. Simplify and express your answer in the form $a+bi$: $\dfrac{2i}{3-4i}$

(2 pts)

ANSWER: _____

B. Simplify $\dfrac{i^{13}-2i^{23}+i^{8}}{i^{-12}-2i^{10}}$ and express your answer in the form $a+bi$

(3 pts)

ANSWER: _____

C. If $x=1-i$ and $y=1+i$ evaluate $\dfrac{x^3+y^3}{3x^2+3xy}$ and express your answer in the form $a+bi$.

(5 pts)

ANSWER: _____

Name _____ Score _____ School _____

Event 1: ALGEBRA II — Complex Numbers (No Trig or Vectors) 2011

A. (2 pts) Solve: $6x^2 + 72 = 0$

ANSWER: _____ $x =$ _____

B. (3 pts) Simplify: $\dfrac{-2i^{19} + i^{22} + 4i^7}{2i^{36} + i^{1201}}$. Write your answer in the form $a + bi$.

ANSWER: _____

C. (5 pts) Find the square roots of the complex number $-6 + 12\sqrt{6}\,i$. Write your answer in the form $a + bi$.

ANSWER: _____

Name _____ Score _____ School _____

Event 1: ALGEBRA II – Complex Numbers (No Trigonometry or Vectors) 2010

A.

(2 pts) If $z=\frac{1+i}{1-i}$, find $z-\bar{z}$. Write your answer in the form $a+bi$.

ANSWER: _____

B. Solve for x: $x^4=8x$. Write your answer in the form $a+bi$.

(3 pts)

ANSWER: _____

C. If $z=3-4i$ and $w=4+2i$, find $\overline{\left(\frac{z}{w}\right)}\left|\frac{z}{w}\right|$. Write your answer in the form $a+bi$.

(5 pts)

ANSWER: _____

Name _____ Score _____ School _____

Event 1: ALGEBRA II — Complex Numbers (No Trigonometry or Vectors) 2009

A. Simplify: $\frac{1}{1+2i} - \frac{2}{1-3i}$

(2 pts)

ANSWER: _____

B. Simplify: $\frac{4i^{34} - 3i^{41}}{12i^{67} + 5i^{456}}$. Write your answer in the form $a+bi$.

(3 pts)

ANSWER: _____

C. Solve for x: $x = 2 + \frac{3+i}{1 - \frac{6-2i}{1-2i}}$. Write your answer in $a+bi$ form.

(5 pts)

ANSWER: _____

Name_____ Score_____ School_____

Event 1: ALGEBRA II – Complex Numbers (No Trig or Vectors) 2008

A. (2 pts) Find the value of $\frac{a}{b}$, if $a = \frac{1-3i}{1+i}$ and $b = \frac{1+i}{2-3i}$. Write your answer in the form $a+bi$.

ANSWER _____

B. (3 pts) Find all possible values for the following, where n is an integer:

$(i^{n-1} + i^n - i^{n+1} - i^{n+2})^2$

ANSWER _____

C. (5 pts) Express the complex number $R = \sqrt{1+i\sqrt{3}} + \sqrt{1-i\sqrt{3}}$ in the form $a+bi$.

ANSWER _____

Name_____ Score_____ School_____

Event 1: ALGEBRA II – Complex Numbers (No Trig or Vectors) 2007

A. (2 pts) If $z = 3 + 4i$ and $f(z) = z^2 + 6z + 25$, evaluate $f(\bar{z})$. $\bar{z}$ is the conjugate of z.

ANSWER _____

B. (3 pts) Simplify:

$$\left[\frac{\sqrt{2}}{2}(1-i)^{15}\right](1+i+i^2+i^3+\ldots+i^{15})$$

ANSWER _____

C. (5 pts) Solve:

$$(x^2-1)\sqrt{5} = (x^2-5x+1)i$$

ANSWER _____

Name_____ Score_____ School_____

Event 1: Algebra II - Complex Numbers (No Trigonometry or Vectors) 2006

A. (2 pts) If $\left[(2+3i)^2+16\right]i$ is written in the form $a+bi$, find b.

ANSWER: _____

B. (3 pts) Simplify:

$$\left(\frac{1}{2}\sqrt{2}+\frac{1}{2}\sqrt{2}i\right)^{30}$$

ANSWER: _____

C. (5 pts) Find the square roots of the complex number $21 - 20i$ in the form $a + bi$.

ANSWER: _____

Name_____ Score_____ School_____

Event 1: Algebra II - Complex Numbers (No Trigonometry or Vectors) 2005

A. (2 pts) If $\left[(9-5i)^2-18\right]i$ is written in the form $a+bi$, find $a-2b$.

ANSWER: _____

B. (3 pts) Simplify and write your answer in $a + bi$ form:

$$1+\frac{i}{1-\frac{i}{1+i}}$$

ANSWER: _____

C. (5 pts) Solve for x: $(6-i)(8+2i)-(3+i)x=0$. Leave your answer in the form $a+bi$.

ANSWER: _____

Name_____ Score_____ School_____

Event 4: Algebra II - Complex Numbers (No Trigonometry or Vectors) 2004

A. (2 pts) Find the reciprocal of the absolute value of the conjugate of $3 - 4i$.

ANSWER: _____

B. (3 pts) Simplify and write your answer in $a + bi$ form:

$$\frac{i^{13} - 2i^{23} + i^{8}}{i^{-12} - 2i^{10}}$$

ANSWER: _____

C. (5 pts) Simplify and write your answer in $a + bi$ form:

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

ANSWER: _____

Name_____ Score_____ School_____

Event 4: Algebra II - Complex Numbers (No Trigonometry or Vectors) 2003

A. (2 pts) Simplify:

$$\frac{9+i}{3i-6}-i$$

Express answer in the form $a + bi$.

ANSWER: _____

B. (3 pts) If $z = -5 - 4i$ and $w = -2 + i$, find $\left|\frac{z}{w}\right|$.

ANSWER: _____

C. (5 pts) For complex number u, let $\bar{u}$ be the conjugate of u.
Find all u if $u^2 + u\bar{u} - \bar{u}^2 = 4 + 4\sqrt{3}i$.

Express answer in the form $a + bi$.

ANSWER: _____

Name_____ Score_____ School_____

Event 4: Algebra II - Complex Numbers (No Trigonometry or Vectors) 2002

A. (2 pts) Find the conjugate of $\frac{-21-12i}{2-i}$. Write your answer in $a+bi$ form.

ANSWER: _____

B. (3 pts) If $z=a+bi$ and $\frac{1}{z}=\frac{1}{-2b}+\frac{1}{8}i$, find a and b.

ANSWER: $a=$_____ $b=$_____

C. (5 pts) Determine the real values of x and y for which the following is true:

$$(5-i)x-(3+4i)y=\frac{12i^{200}}{15i^{75}}-\frac{19}{4}+\frac{88i^{315}}{110}+\frac{7}{12i}$$

ANSWER: $x=$_____ $y=$_____

Name _____ Score _____ School _____

Event 4: ALGEBRA II - Complex Numbers (no trig or vectors)

2001

A. (2 pts) Find the 3 cube roots of 27. Write your answers in the form $a + bi$.

ANSWER _____

B. (3 pts) Simplify and write your answer in $a + bi$ form.

$$\frac{i^{42} - 2i^{13} + i^{27}}{3 + i^{15} - 2i^{22} + i^{499}}$$

ANSWER _____

C. (5 pts) If $\frac{i}{i+1} - \frac{i}{i-1} + \frac{z}{2} = \frac{i+1}{i-1}$, find $z + \frac{1}{z}$.

Write your answer in $a + bi$ form.

ANSWER _____

Name _____ Score _____ School _____

Event 4: ALGEBRA II - Complex Numbers (no trig or vectors)

2000

A. (2 pts) If $x = 1 + i$ and $y = 1 - i$, evaluate

$$\frac{x^2 - y^2}{xy}$$

ANSWER _____

B. (3 pts) The absolute value of a complex number is $\sqrt{53}$.
The real part is 9 more than the imaginary part.

Find all such complex numbers for which this is true.
Write your answer(s) in the form $a + bi$.

ANSWER _____

C. (5 pts) Solve for z:

$$\frac{1+3i}{1-3i} - 4z + 12iz = 1$$

Write your answer in the form $a + bi$.

ANSWER _____

Name_____ Score_____ School_____

Event 4: Algebra II - Complex Numbers (no trig or vectors) 1999

A. (2 pts) Simplify:

$$\frac{\sqrt{3}}{i}+\frac{i}{\sqrt{3}}-\frac{\sqrt{3}}{3i}$$

Express your answer in the form $a + bi$.

ANSWER: _____

B. (3 pts) If $x=3+\frac{2}{3}i$ and $y=-5+3i$, find the reciprocal of $x+y$. Express your answer in the form $a+bi$.

ANSWER: _____

C. (5 pts) Given: $\frac{2-i}{4+i}-\frac{2i}{3-i}=a+bi$

Find: $a+b$

ANSWER: _____

Name _____ Score _____ School _____

Event 4: ALGEBRA II - Complex Numbers (no trig or vectors) 1998

A. (2 pts) Find z: $-4 + 3i - (2 - 3i)\,z = 4i$ Write the answer in the form a + bi.

ANSWER: _____

B. (3 pts) Find the reciprocal of z if:

$$z = \frac{1}{i} + \frac{1}{1 + i}$$

Write the answer in the form a + bi.

ANSWER: _____

C. (5 pts) The absolute value of Z is 1. The sum of Z and its conjugate is 1. Solve for Z. Write your answer(s) in the form a + bi.

ANSWER: _____

Meet 5, Event 1: ALGEBRA II
Complex Numbers

2018

A. $\frac{9}{13}-\frac{6}{13}i$

B. $-\frac{1}{8}+\frac{1}{8}i$

C. $3-\frac{13}{3}i$

2017

A. $\frac{57}{26}+\frac{6}{13}i$

B. $-\frac{1}{5}-\frac{4}{15}i$

C. 15

2016

A. $-\frac{3}{10}+\frac{11}{10}i$

B. $\frac{41}{53}-\frac{11}{53}i$

C. 15/16

2015

A. $-\frac{5}{17}-\frac{14}{17}i$

B. $5-2i,\ -5+2i$

C. $\frac{1}{2}-\frac{1}{2}i$

2014

A. 1

B. $4+7i,\ -7-4i$

C. $-2+5i,\ -2-5i$

2013

A. $5+3i$

B. 70

C. (625, 150)

2012

A. $-\frac{8}{25}+\frac{6}{25}i$

B. $\frac{1}{3}+i$

C. $-\frac{1}{3}-\frac{1}{3}i$

2011

A. $\pm 2\sqrt{3}\,i$

B. $-\frac{4}{5}-\frac{3}{5}i$

C. $2\sqrt{3}+3\sqrt{2}\,i,\ -2\sqrt{3}-3\sqrt{2}\,i$

2010

A. $2i$

B. $0, 2, -1\pm\sqrt{3}\,i$

C. $\frac{\sqrt{5}}{10}+\frac{11\sqrt{5}}{20}i$

2009

A. $-i$

B. $\frac{16}{169}-\frac{63}{169}i$

C. $1+i$

2008

A. $-\frac{9}{2}+\frac{7}{2}i$

B. $\pm 8i$

C. $\sqrt{6}$

2007

A. $36-48i$

B. 0

C. $\frac{1}{3}-\frac{\sqrt{5}}{3}i,\ \frac{1}{2}-\frac{\sqrt{5}}{2}i$

2006

A. 11

B. $-i$

C. $-5+2i,\ 5-2i$

2005

A. 14

B. i

C. $\frac{77}{5}-\frac{19}{5}i$

2004

A. 1/5

B. $\frac{1}{3}+i$

C. $\frac{11}{2}-\frac{1}{2}i$

Note: Answers are shown as they appear on the original answer keys. There may be inconsistencies with the formatting of these answers. In all cases, consult the Guidelines for Forms of Answers to determine the correct formatting.

2003

A. $-\frac{17}{15}-\frac{26}{15}i$

B. $\sqrt{205}/5$

C. $1+\sqrt{3}\,i\,,\ -1-\sqrt{3}\,i\,,\ \sqrt{3}+i\,,\ -\sqrt{3}-i$

2002

A. $-6+9i$

B. $a=4\,,\ b=-4$

C. $x=-3/4\,,\ y=1/3$

2001

A. $3,\ -\frac{3}{2}\pm\frac{3\sqrt{3}}{2}i$

B. $\frac{1}{29}-\frac{17}{29}i$

C. $-\frac{15}{4}i$

2000

A. $2i$

B. $2-7i\,,\ 7-2i$

C. $-\frac{9}{100}-\frac{3}{25}i$

1999

A. $-\frac{\sqrt{3}}{3}i$

B. $-\frac{18}{157}-\frac{33}{157}i$

C. $-29/85$

1998

A. $-\frac{5}{13}-\frac{14}{13}i$

B. $\frac{1}{5}+\frac{3}{5}i$

C. $\frac{1}{2}\pm\frac{\sqrt{3}}{2}i$

Note: Answers are shown as they appear on the original answer keys. There may be inconsistencies with the formatting of these answers. In all cases, consult the Guidelines for Forms of Answers to determine the correct formatting.