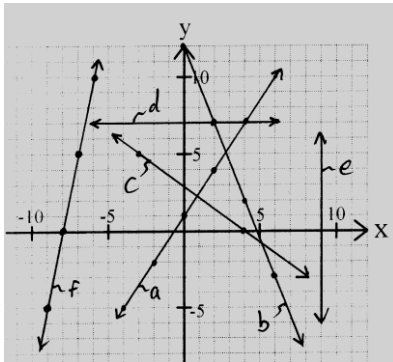# Cartesian Geometry I
Test

All Problems are worth 4 points, unless otherwise indicated.
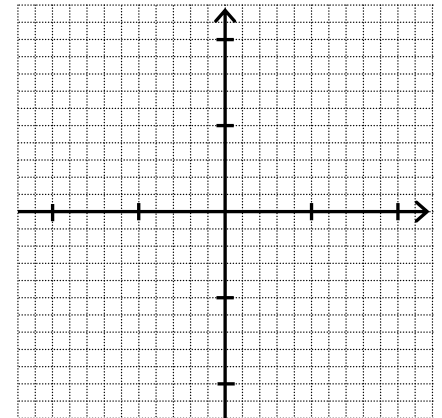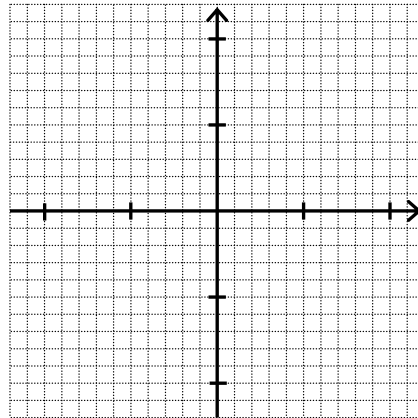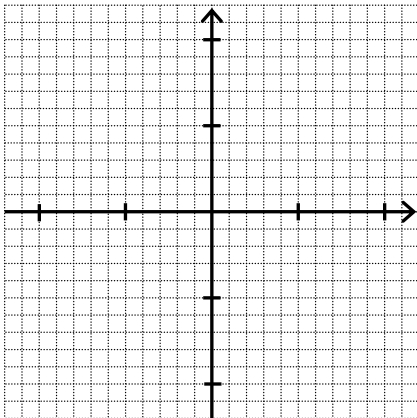
1) Give the equation of each line, given below.

   a)

   b)

   c)

   d)

   e)
   f)

2) Find the exact point of intersection of the lines 1a and 1c, given above. (You may use any method.)

Use the graphs below to graph each of the following equations. Be sure to label each one.
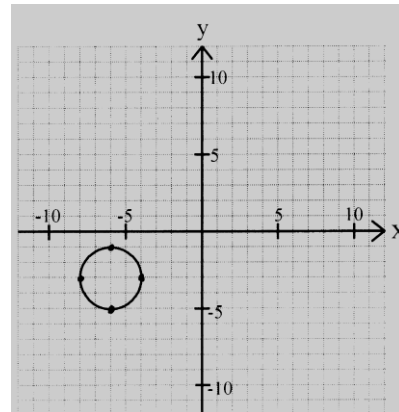
a) $y = \frac{2}{3}x - 4$

b) $y = -x + 1$

c) $y = -3x$

d) $2x + y = 6$

e) $4x - 5y = 15$

f) $x = y^2 - 6$

4) Give two solutions to the equation of the below graph.

3)

5) Find the (exact!) common solution of these two equations. (You must use the method of substitution.)

$3x + 5y = 1$
$2x - y = 5$

Give the equation of the line that…

a) Has a slope of -3 and passes through the point $(2,-7)$.

b) Passes through the points $(3,4)$ and $(6,9)$.

c) Passes through the point $(1,-7)$ and is perpendicular to the line $y = \frac{2}{3}x - 245$

6) Find the (exact!) common solution of these two equations. (You must use the method of linear combination.)

$2x + 5y = 7$
$3x - 2y = -18$

8) *Challenge!* (Do only if you have extra time.)
(2 points extra credit)
Give the equation of the below graph.

7)
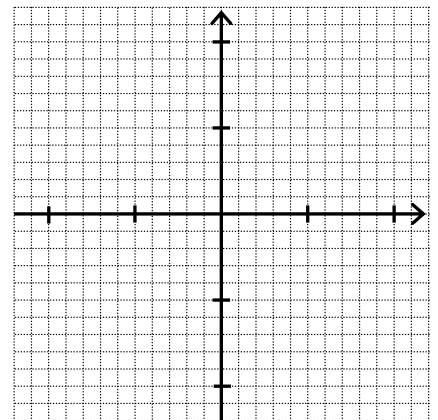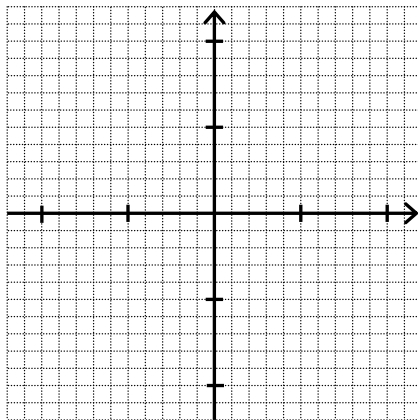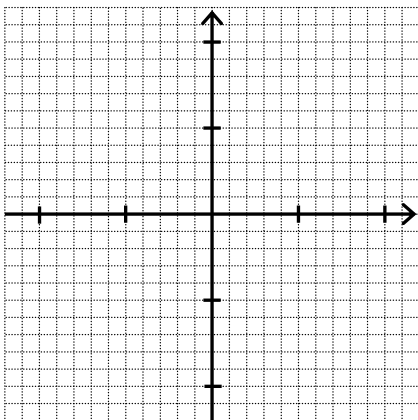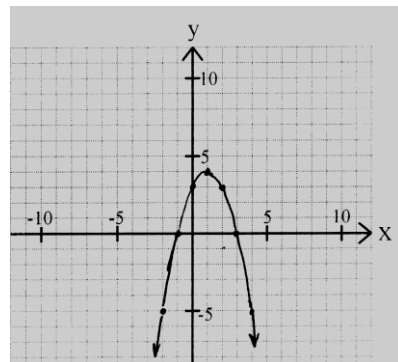
Trig II Test

Trig mental math (1 point each)

Each of the below problems should be done in your head, without the use of a calculator. Only write down the final answer. All ten problems should be completed within 2 minutes.
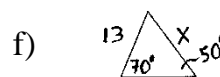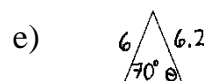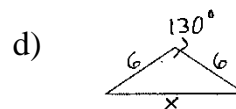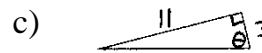
For #1-7, give exact answers.

1) $\sin(30°)$

2) $\cos(30°)$

3) $\tan(30°)$

4) $\sin(45°)$

5) $\cos(90°)$

6) $\tan(45°)$

7) $\sin(90°)$

For #8-10, give decimal approximations.

8) $\cos(25°)$

9) $\sin(10°)$

10) $\tan(70°)$

For the rest of the problems, you may either use a calculator in order to give the answer as a decimal approximation, or you can write your answer in terms of a trig function, such as $7\sin(42°)$.

11) Find the indicated variable.
     (4 points each)

a)

b)

c)

d)

e)

f)
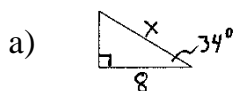
12) A train climbs up a mountain on a track that has a constant inclination of 2.3°. How much elevation has the train gained after 10 miles? (4 points)

13) Explain <u>what</u> this identity means, and <u>why</u> it is true.
(4 points)

$\sin(180° − \theta) = \sin(\theta)$

14) *Challenge!*
Find the dihedral angle of a regular tetrahedron. (A tetrahedron is a solid that has four equilateral triangular faces. The dihedral angle is the angle at which two faces come together, as shown here.) (4 points)
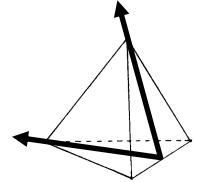
Complex Numbers, Part I Test

Problems are worth 4 points each.

Simplify

1) $(6-2i)(3+i)$

2) $(12-5i)^2$

3) $\dfrac{8+2i}{1+i}$

4) $[x + (3+7i)][x + (3-7i)]$

5) $\left(\frac{1}{2} + \frac{\sqrt{3}}{2}i\right)^4$

Find each value, given these function definitions:

$$f(x) = 2x - 5$$
$$g(x) = x^2 + 4$$

6) $f(3)$

7) $g(f(4))$

8) $f(g(x))$

Solve. (Complex numbers are allowed).

9) $3x^2 + 12 = 0$

10) $x^4 + 4x^2 - 45 = 0$

11) $(x+3)^2 = 3x + 4$

"Complex" Factor (Each one is possible!)
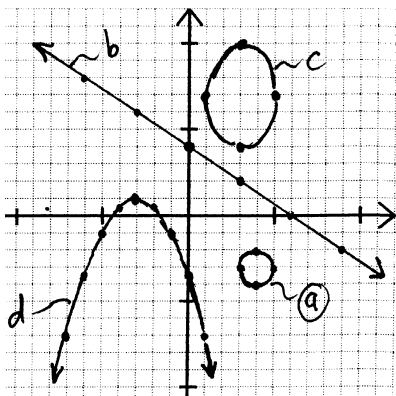
12) $x^2 - 3$

13) $x^2 + 17$

14) $x^2 - 10x + 61$

Cartesian Geometry II Test

All Problems are worth 4 points.

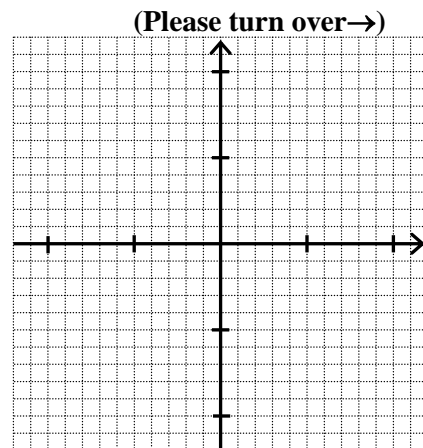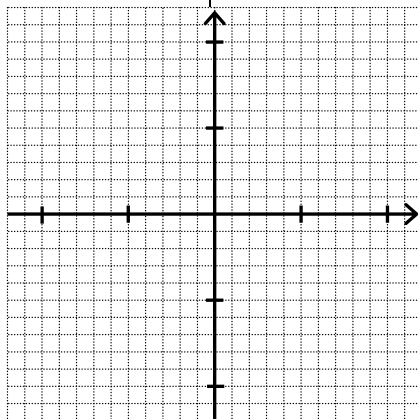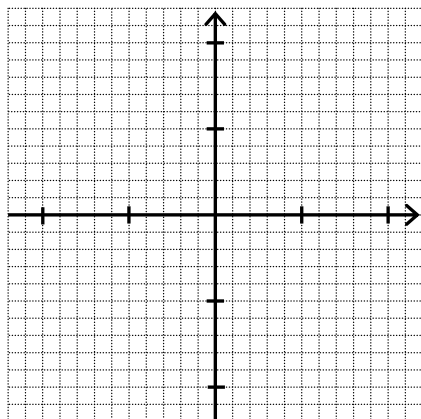1)   Give the equation of each graph, given below.

  a)

  b)

  c)

  d)

2)   Give two solutions to the equation you gave as an answer to #1d, above.

3)   Graph each of the following on the graphs below. Make sure you label each one.

  a) $y = -2(x-1)^2 + 5$

  b) $x - 3y = 12$

  c) $x^2 + (y+2)^2 = 4$

  d) $\frac{x^2}{25} + \frac{y^2}{9} = 1$

  e) $x = -y^2 + 3$

  f) $25x^2 + 4y^2 = 100$

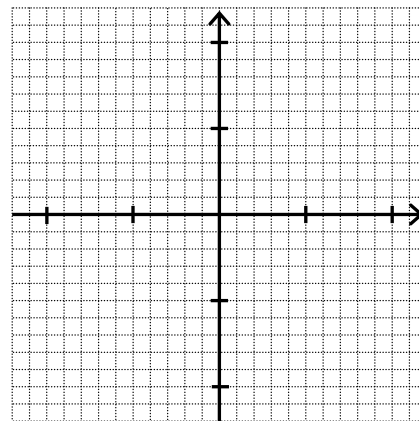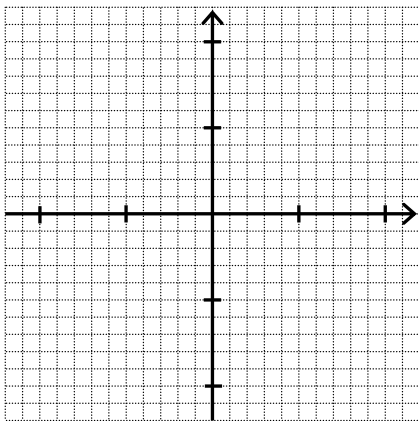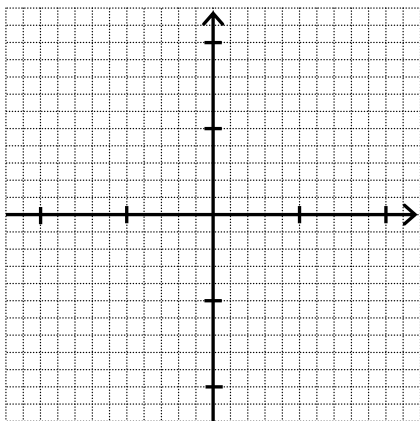 g) $y^2 + 10y + 17 = 2x - x^2$

(Please turn over→)

4) Find the exact common solution to the two equations.
$x - y = 2$
$(x-5)^2 + (y-1)^2 = 4$

6) Give the x-intercepts y-intercepts, and roots for:
$y = (x+1)^2 - 9$

7) *Challenge!* (2 points extra credit.)
graph $20y^2 = 30x - 5x^2$

5) Using the equation
$x^2 + y^2 - 6x + 4y + 4 = 0$
Where is $y = -5$?

Trig III Test

Give an answer as accurately as possible
(1 point each.) You may not use a calculator!

1) $sin(150°)$

2) $cos(135°)$

3) $tan(120°)$

4) $csc(15°)$

5) $sec(120°)$

6) $sin^{-1}(\frac{\sqrt{3}}{2})$

7) $cot^{-1}(\sqrt{3})$

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

You may use a calculator, if you wish, on the rest of the test.

9) Find the variable indicated. **(4 points each.)**

a)

b)

c)

d)

e)

f)
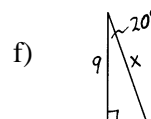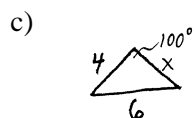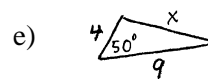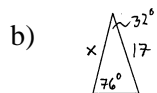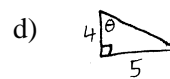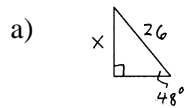
10)   Find the variable indicated.   (**4 points each.**)

a)

b)
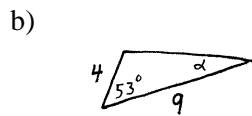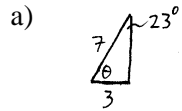
11)   The *Golden Rectangle* is a special rectangle where the ratio of the base to the height is Φ:1, where $\Phi \approx 1.618$. What is the angle that is formed by the base and a diagonal?
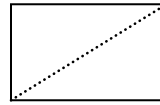
12)   A plane is about to land on an 8-km long runway. At a given moment, the plane is 5km from one end of the runway and 4km from the other end. How far above the ground is it?

13)   Explain why the following identity is true, or how it can be shown/proved to be true.
$tan^2\alpha + 1 = sec^2\alpha$

Cartesian Geometry III Test

Calculators should not be used on this test.

1) Calculate the distance between the points $(2,-6)$ and $(-5,-2)$. (4 points)

2) Find the domain and range of each function. (2 points each)

a) $f(x) = \dfrac{6}{x-4}$

b) $h(z) = 3z + 2$

c) $g(y) = 2 + \sqrt{y+6}$

3) Give an equation for which the graph of that equation is a hyperbola. (2 points)

4) Convert to degrees: (2 points each)

a) $\pi/3$

b) $11\pi/8$

5) Convert to radians: (2 points each)

a) $150°$

b) $720°$

6) Evaluate (2 points each)

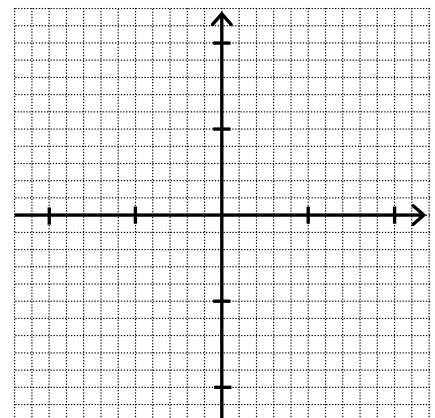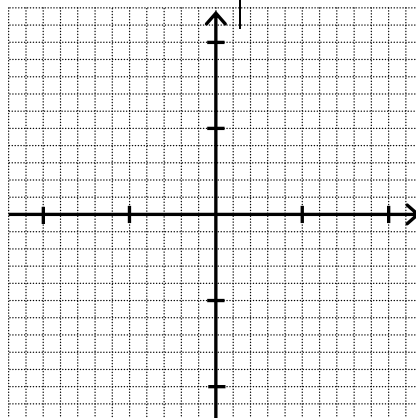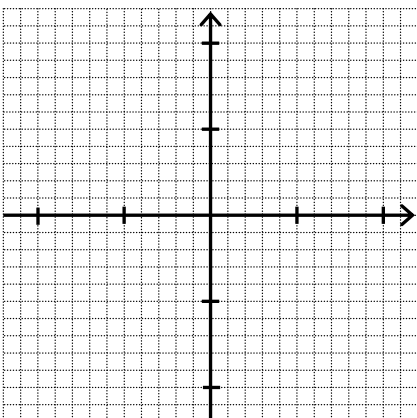a) $\cos(4\pi/3)$ 　　　　 c) $\sec(\pi/6)$

b) $\tan(3\pi/4)$ 　　　　 d) $\csc(5\pi/4)$

7) Give two-variable equations (using x and y) that express each of the two below sentences. Then graph each of the two equations and find a common solution – the solution that satisfies both conditions. (4 points)

"The sum of two numbers is 32. The larger number is 12 greater than twice the smaller."

8)   A cannonball is shot out of a cannon, and
   travels along the parabolic curve given as
      $y = -\frac{1}{100}(x-200)^2 + 400$
   where y is the height above the ground (in feet) and
   x is the horizontal distance from the cannon. The
   coordinates of the mouth of the cannon is (0,0).
   What are the coordinates of the ball when it is 100
   feet above ground? (2 points)

9)   Given $f(x) = x^2 - 5$, graph each of the following.
       Be sure to label your graph!
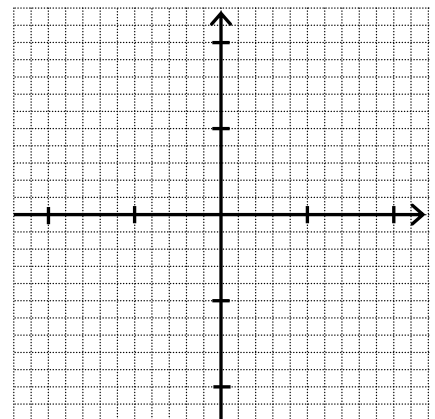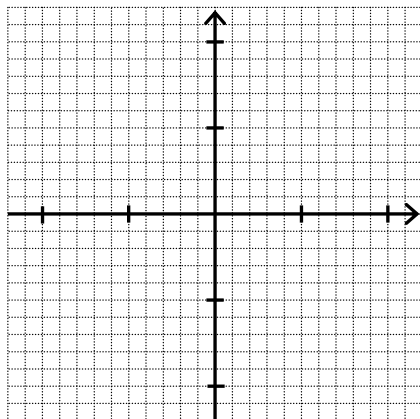   (4 points on the graph must be accurate.)
       (2 points each)
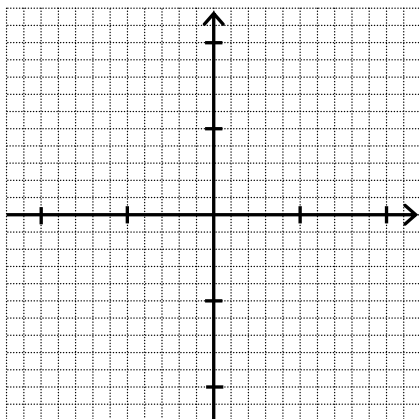
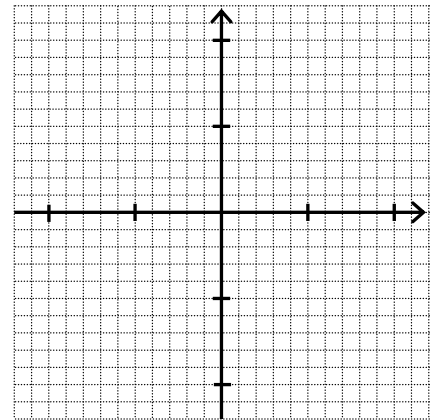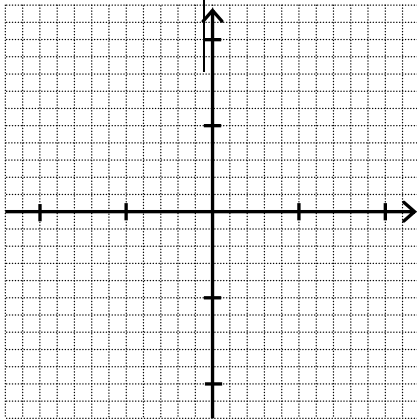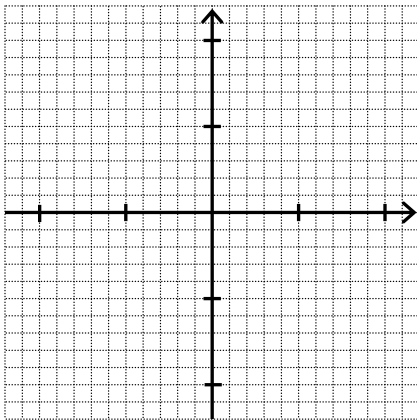   a) f(x)   c) f(x+3)

   b) f(x) + 6   d) f(−x)

10)   Graph each equation.
      Be sure to label your graph! (4 points each)
      (4 points on the graph must be accurate.)
   a) $x^2 + y^2 + 6y = 0$

   b) $f(x) = (x-5)(x-3)^2(x-1)$

   c) $f(x) = x^3 + 4x^2 + 3x$

Logs & Exponential Growth Test

(from 10th Grade)

You may not use a calculator for Problems 1-11.

(1 point each.)

1) $8^{1/3}$

2) 8^{-2}

3) $9^{-5/2}$

4) $\log_2 16$

5) $\log_9 3$

6) $\log_4 \left(\frac{1}{16}\right)$

7) $\log_3 (-\frac{1}{3})$

8) $\log_4 (\frac{1}{2})$

9) $\log_9 (27)$

Solve each equation. (3 points each.)

10) $5^{(3x+1)} = 125$

11) $11 + 4\log_9(2x-5) = 5$

You may use a calculator for #12-16. (3 points each.)

12) The enrollment of a college is increasing by 9% per year. If the enrollment is currently 5600, then what will it be after 20 years if that growth rate continues?

13) A town's population grew from 15,327 to 18,802 over a 5-year period. What was the average annual growth rate?

14) An investment account is growing at 6% annually. How long does it take the account to triple?

15) At 2.8% APR, how long does it take an account to go from $800 to $1600 with monthly compounding?

16) Given an initial deposit of $8000, an APR of 3.4%, and an ten-year period of time that the money is invested in the account, calculate the ending balance given continuous compounding.