Name: Jason Gunn

ID: 06039966

Year: 1

Unit Code: CMP1627

Assignment: 2

Course: Games Computing

Unit: Introductory Games Studies

Lecturer: Mark Doughty

1. Describe how to find the intersection of two straight lines. **[10]**

In order to find the intersection point of two straight lines we must first find the Gradient/Slope of "m", and the point in which each line intersects the "y" axis "c".

To begin with we would be given a set of coordinates, one set for each line:

$$(x1, y1), (x2, y2)$$

For the purpose of this example we will use:

$$(9, 4), (7, 3)$$

To find "m" we must use the following equation:

$$m = y2 – y1/x2 – x1$$

$$E.G\ m = 3 – 4/7 – 9 = -1/-2$$

After doing this calculation, we then know what "m" is equal to, (In this case y/x). We now need to find out the value of "c", to find this we must use the following equation:

$$y = mx + c$$

We then need to take one set of coordinates, either (x1, y1) or (x2, y2) and plug them into our equation, we must also plug in our newly found "m" value:

$$E.G\ 4 = -1/-2 *9 + c$$

Once we have done this, we must work out the equation, and will be left with:

$$E.G\ 4 = 4.5 + c$$

We then need to cancle out the "j + c" j being the value we are left with, to do this we must add if it is negative, or subtract if it is positive from both sides:

$$E.G\ -0.5 = c$$

We then must rearrange it so that the equation is set out logically:

$$E.G\ c = -0.5$$

We can do this equation with both sets of coordinates we have to ensure that the answer is correct!

We must then repeat the above process for the second set of coordinates (Not done here as it is just repeating). Once we have worked out m1 (m of coordinates 1) and m2 (m of coordinates 2) as well as c1, and c2 we have our two line equations of:

$$y = mx + c$$

If m1 and m2 are equal, then the two lines are parallel and never intersect, unless c1 and c2 are equal, in which case they are the same line. If this is not the case then the two lines do intersect at some point, and we must then work out where they intersect.

Now we need to use either of the following equations (We can do both again to check accuracy of our answer):

$$y3 = m1(x3 – x1) + y1$$
$$y3 = m2(x3 – x2) + y2$$

However before we do this, we need to work out the value of "x3" to do this we use:

$$x3 = (m1*1 – m2*2 + y2 – y1)/(m1-m2)$$

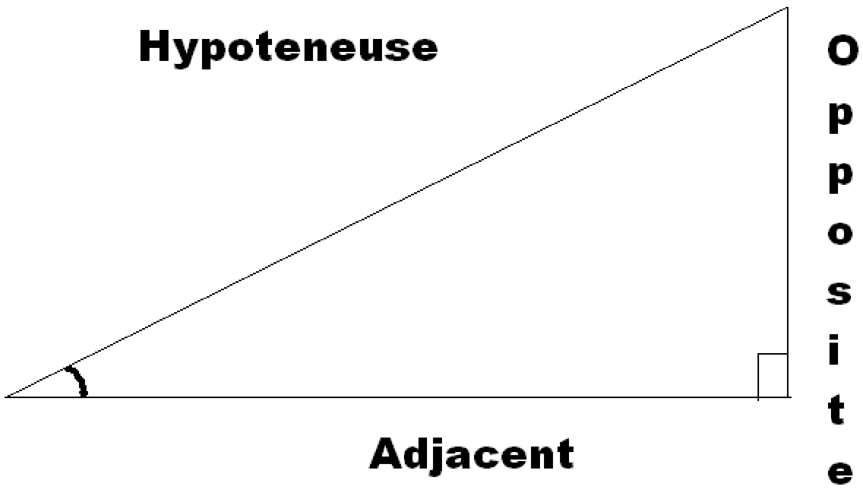
You then need to do the equation, and are left with the value of "x3", which you can now take back and plug into the equation it was needed for. Once done you will both the value of y3, and x3, and this is your answer:

The two lines intersect at:
(x3, y3)

2. Explain how you use trigonometry functions to find the angles and lengths of sides in right angled triangles. **[10]**

To use trigonometry, you need at least 2 bits of information, a angle, and a length. This enables you to work out the length you require by using either Sin, Tan or Cos. The triangle you are using must be a right angle triangle.

A right angle triangle is made up of 3 angles, and 3 sides, we must know the name of each side in order to use Trigonometry:



The 3 functions of trigonometry are:

Sin (angle) = Opposite/Hypotenuse

Cos (angle) = Adjacent/Hypotenuse

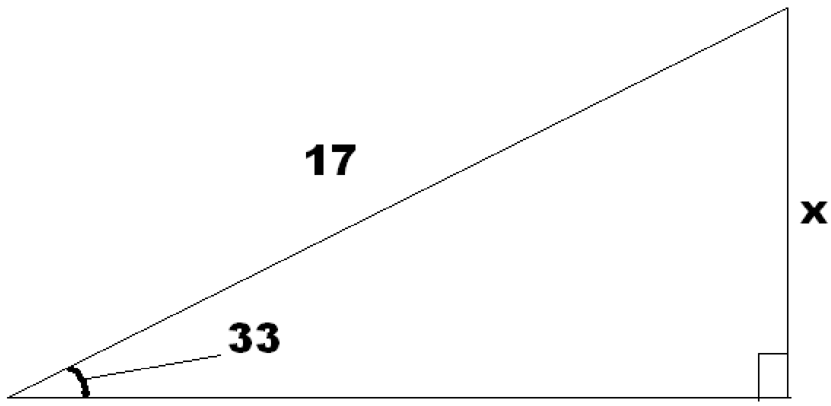
Tan (angle) = Opposite/Adjacent

<u>Length</u>

Which function you use, is dependant on which information you have, however the above shows clearly which you would use for each situation. For example if you wanted to find the opposite angle, you can see you would use either Sin or Tan, and if you had the Hypotenuse but not the Adjacent side then you can only use Sin. You must go through this process for each question you are trying to solve.

To find the length we must go through a process:

E.G



For this we have the angle, and the Hypotenuse, and as we are trying to find the opposite side we must use Sin.

So for the equation:

Sin a = Opposite/Hypotenuse

We substitute in our values:

Sin33 = x/17

We then need to rearrange the sum, so that we can work out x, to do this in this example we need to multiply both sides by 17 to get:

17(sin33) = x

The answer being:

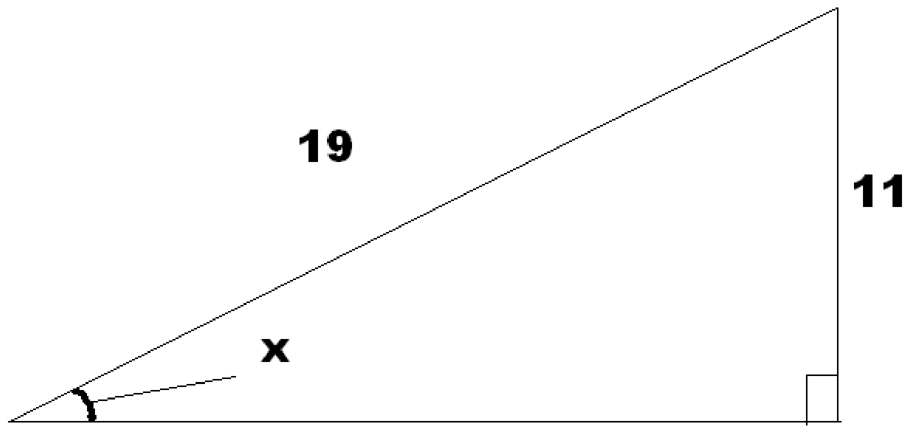
9.26

We do the same for each function, however substituting the function used dependent on the information we have.

Angle

To find a missing angle we must go through a process:

First we must look at what information we have, and work out which function to use, then put it into action, E.G:



In this case we do not have the angle, and are trying to find it, but we do have both the Hypotenuse and the Opposite sides so again we will use the Sin function so:

Sin x = Opposite/Hypotenuse

Substitute in your values:

Sin x = 11/19

Now we need to rearrange it to get sin on the right side, so we take sin from each side, and are left with Inverted Sin:

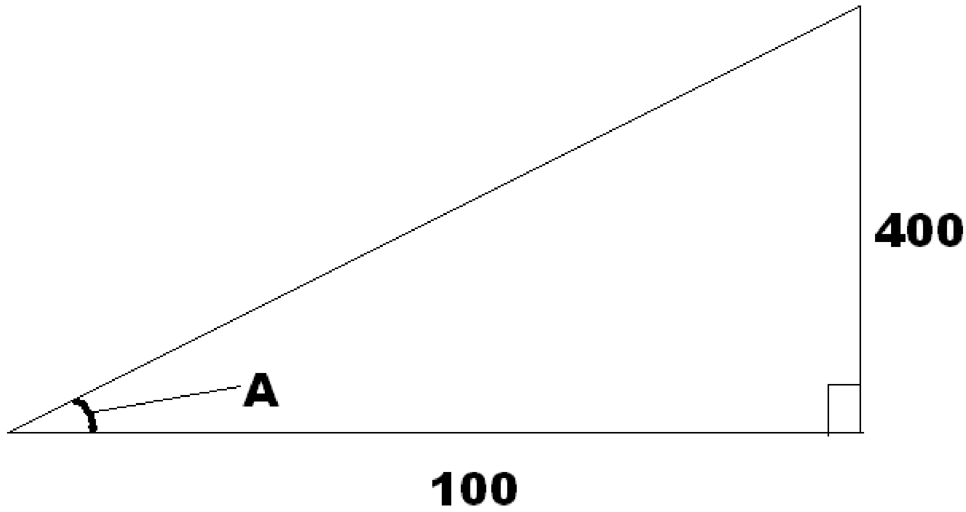
x = Sin-1(11/19)

We then need to do the calculation of "Sin-1(11/19):

35.38

So we now know what our angle is, as with length you repeat the above process for each different function to obtain the correct answer depending on what information you have.

2. In a game, your character shoots a laser weapon at a target which is in a stationary orbit above the planet. He is positioned 100 miles away (horizontally) from the target which is 400 miles above the surface.



a. What angle should he aim at if the laser will follow a straight line path? **[5]**

For this question we must use the Tan Function, as with have the opposite and adjacent sides, and we need to find the angle:

Tan A = Opposite/Adjacent

Tan A = 400/100

We now need to remove Tan from the left, and onto the right, so we invert it (Subtract it from both sides)

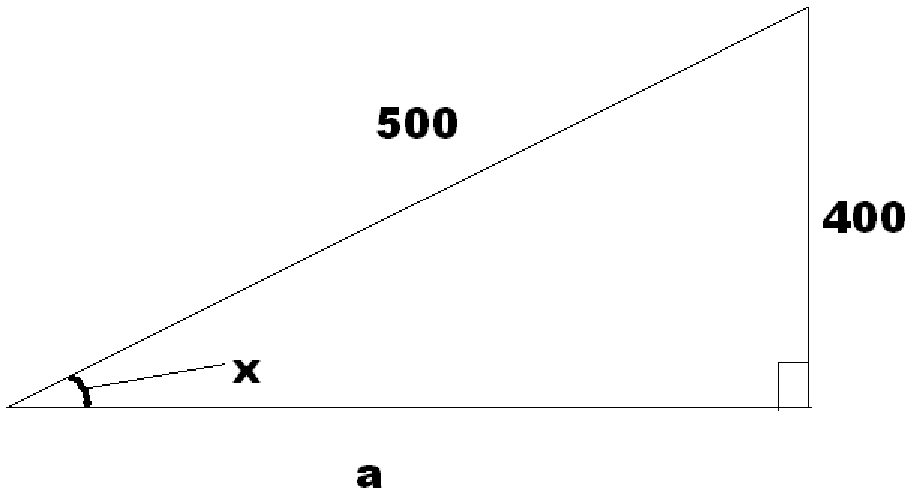
A = Tan-1(400/100)

A = Tan-14

A = 75.96

b. If the maximum distance the laser can travel is 500 miles, how far back from his current position can your player move to fire the weapon and still hit the target? **[5]**

To solve this we can use Pythagorean Theorem, we have the Opposite length of 400, and the Hypotenuse length of 500 and need to find the new length of the Adjacent side.



As we are not trying to find the Hypotenuse we must alter the Pythagorean Theorem equation from

$$h^2 = a^2 + o^2$$

(h, o and a being Hypotenuse, Opposite and Adjacent)

To:

$$a^2 = h^2 - o^2$$

$$a^2 = 500^2 - 400^2$$

$$500^2 = 250,000$$

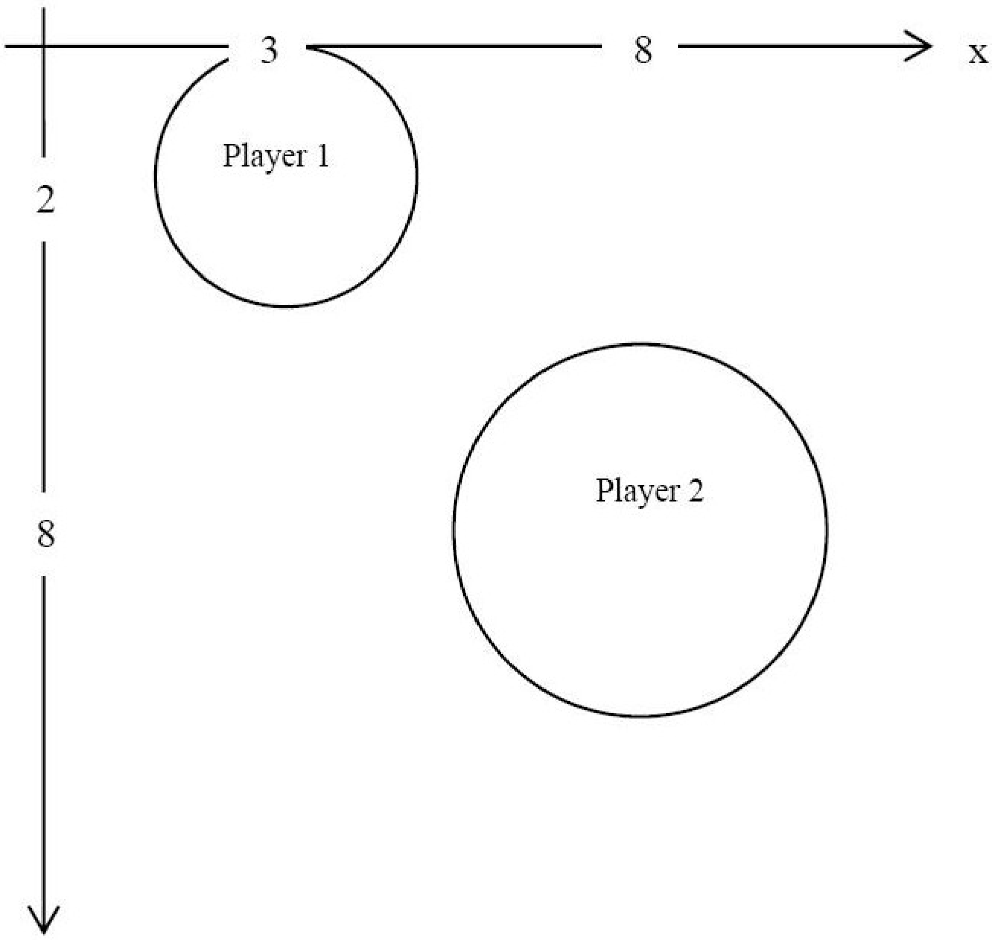
$$400^2 = 160,000$$

$$a^2 = 250,000 - 160,000 = 90,000$$

Square root of 90,000 = 300

The maximum distance the player can move back is 200 miles from his current position of 100 miles, however 300 miles from one end of the line to the other.

4. A 2D computer game consists of two characters moving around on a flat plane. Player 1 is positioned at (3,2) and has a 'collision area radius' of 2 units. Player 2 is positioned at (8,8) and has a collision area radius of 3 units.



Player 1 is asked to move in a straight line to the point (10,5).

a. What is the equation of the line along which Player 1 moves? **[5]**

For this we need to use what was explained in question 1, we have the coordinates:

(3,2),(10,5)

We must first find "m":

m = y2 – y1/x2 – x1

m = 5 – 2/10 – 3 = 3/7

m = 3/7

Now we need to find "c"

y = mx + c

5 = 3/7*10 + c

5 = 4.29 + c

We need to remove 4.29 from the right side, so we must minus it from both sides:

0.71 = c

c = 0.71

We can check this by doing the same sum for the other coordinates:

2 = 3/7*3 + c

2 = 1.29 + c

0.71 = c

c = 0.71

Now we have confirmed that this is correct, we have our answer:

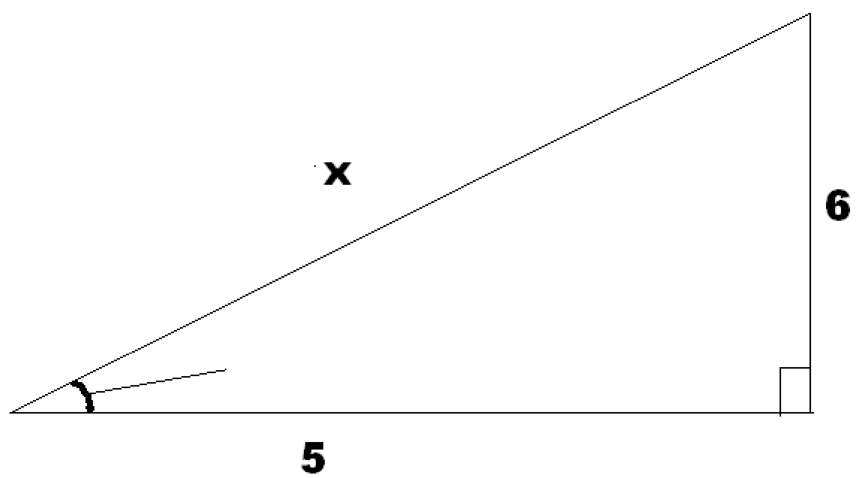
y = 3/7x + 0.71

b. What is the separation of the two players before Player 1 moves? **[5]**

To find the answer we must use Pythagorean Theorem. We know that the grid is 8,8 so in order to construct a triangle we must first deduct player 1's position from player 2's.

(8 – 3), (8 – 2)

5, 6



Now that we have this we can use Pythagorean Theorem to find our answer:

$$h^2 = a^2 + o^2$$
$$h^2 = 5^2 + 6^2$$

$$5^2 = 25$$

$$6^2 = 36$$

$$h^2 = 25 + 36$$

$$h^2 = 61$$

Square root of 61 = 7.81

The separation of the two players before player 1 moves is 7.81 Units or more accurately Square root 61.

c. At the point when the two collision area circles touch, what is the players separation? **[2]**

To work this out, we simply need to take the 2 Radii from player 1, and player 2, and add them, to get the answer:

Player 1 Radius = 2, Player 2 Radius = 3

2 + 3 = 5

At the point when the two collision area circles touch, the players separation is 5 units. Assuming that each player is at the centre of the circle.

d. What are the coordinates of player 1 at this point? **[8]**

You have the coordinates of player 2 (8,8) we need to take these, along with m1 to work out the value of x:

From the use of a graph I found x to be approximately 6 and y to be approximately 3

The coordinates of player 1 at this point are approximately (6, 3)