1. $\text{sqrt}(0.5^2 + 0.5^2) = \text{sqrt}(0.5) = 0.707$

2. $(0.5 * 0.75) + (0.5 * 1.25) = 1$

3.

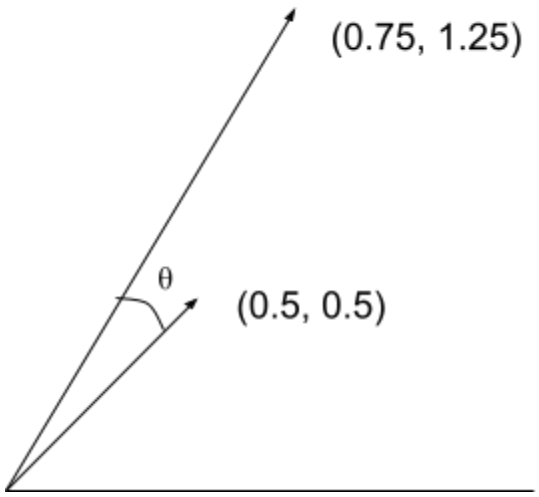
0.5 * 0.75	0.5 * 1.25
0.5 * 0.75	0.5 * 1.25

=

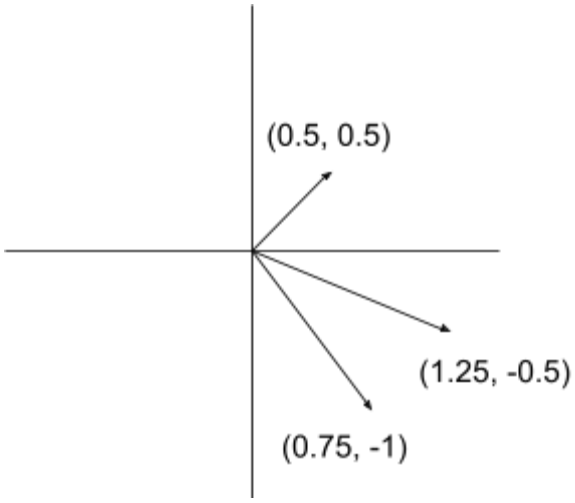
0.375	0.625
0.375	0.625

4. $(0.5 * 0.75) + (0.5 * 1.25) = 1$

5. $\theta = \cos^{-1}(1 / (\text{sqrt}(0.5) * \text{sqrt}(0.75^2 + 1.25^2))) = 0.245 \text{ rad}$



6. $[(0.5 + 0.75), (0.5 + -1)] = [1.25, -0.5]$



7. Classification is when a model takes in an input and produces an output class that it thinks the input belongs to. Prediction is when a model takes in an input and produces a predicted value that is a guess at some unknown attribute of the input. In short, classification means categorical output and prediction means numerical output.

8. **Iteration 1**

   Input 1

   Forward pass:
   $1 * 0 + 0 * 0.5 + 0 * -0.5 = 0$
   $y = 0$

   Update weights:
   (y - t) is zero since the correct output was 0, so the weights do not change.

   Input 2

   Forward pass:
   $1 * 0 + 0 * 0.5 + 1 * -0.5 = -0.5$
   $y = 0$

   Update weights:
   $w_0 = 0 - 0.25 * (0 - 1) * 1 = 0.25$
   $w_1 = 0.5 - 0.25 * (0 - 1) * 0 = 0.5$
   $w_2 = -0.5 - 0.25 * (0 - 1) * 1 = -0.25$

Input 3

Forward pass:
1 * 0.25 + 1 * 0.5 + 0 * -0.25 = 0.75
y = 1

Update weights:
(y - t) is zero since the correct output was 1, so the weights do not change.

Input 4

Forward pass:
1 * 0.25 + 1 * 0.5 + 1 * -0.25 = 0.5
y = 1

Update weights:
(y - t) is zero since the correct output was 1, so the weights do not change.

Iteration 2

Input 1

Forward pass:
1 * 0.25 + 0 * 0.5 + 0 * -0.25 = 0.25
y = 1

Update weights:
$w_0 = 0.25 - 0.25 * (1 - 0) * 1 = 0$
$w_1 = 0.5 - 0.25 * (1 - 0) * 0 = 0.5$
$w_2 = -0.25 - 0.25 * (1 - 0) * 0 = -0.25$

Input 2

Forward pass:
1 * 0 + 0 * 0.5 + 1 * -0.25 = -0.25
y = 0

Update weights:
$w_0 = 0 - 0.25 * (0 - 1) * 1 = 0.25$
$w_1 = 0.5 - 0.25 * (0 - 1) * 0 = 0.5$

$w_2 = -0.25 - 0.25 * (0 - 1) * 1 = 0$

Input 3

Forward pass:
$1 * 0.25 + 1 * 0.5 + 0 * 0 = 0.75$
$y = 1$

Update weights:
(y - t) is zero since the correct output was 1, so the weights do not change.

Input 4

Forward pass:
$1 * 0.25 + 1 * 0.5 + 1 * 0 = 0.75$
$y = 1$
Update weights:
(y - t) is zero since the correct output was 1, so the weights do not change.

Iteration 3

Input 1

Forward pass:
$1 * 0.25 + 0 * 0.5 + 0 * 0 = 0.25$
$y = 1$

Update weights:
$w_0 = 0.25 - 0.25 * (1 - 0) * 1 = 0$
$w_1 = 0.5 - 0.25 * (1 - 0) * 0 = 0.5$
$w_2 = 0 - 0.25 * (1 - 0) * 0 = 0$

Input 2

Forward pass:
$1 * 0 + 0 * 0.5 + 1 * 0 = 0$
$y = 0$

Update weights:
$w_0 = 0 - 0.25 * (0 - 1) * 1 = 0.25$

$w_1 = 0.5 - 0.25 * (0 - 1) * 0 = 0.5$
$w_2 = 0 - 0.25 * (0 - 1) * 1 = 0.25$

Input 3

Forward pass:
$1 * 0.25 + 1 * 0.5 + 0 * 0.25 = 0.75$
$y = 1$

Update weights:
(y - t) is zero since the correct output was 1, so the weights do not change.

Input 4

Forward pass:
$1 * 0.25 + 1 * 0.5 + 1 * 0.25 = 1$
$y = 1$

Update weights:
(y - t) is zero since the correct output was 1, so the weights do not change.

Iteration 4

Input 1

Forward pass:
$1 * 0.25 + 0 * 0.5 + 0 * 0.25 = 0.25$
$y = 1$

Update weights:
$w_0 = 0.25 - 0.25 * (1 - 0) * 1 = 0$
$w_1 = 0.5 - 0.25 * (1 - 0) * 0 = 0.5$
$w_2 = 0.25 - 0.25 * (1 - 0) * 0 = 0.25$

Input 2

Forward pass:
$1 * 0 + 0 * 0.5 + 1 * 0.25 = 0.25$
$y = 1$

Update weights:
(y - t) is zero since the correct output was 1, so the weights do not change.

Input 3

Forward pass:
1 * 0 + 1 * 0.5 + 0 * 0.25 = 0.5
y = 1

Update weights:
(y - t) is zero since the correct output was 1, so the weights do not change.

Input 4

Forward pass:
1 * 0 + 1 * 0.5 + 1 * 0.25 = 0.75
y = 1

Update weights:
(y - t) is zero since the correct output was 1, so the weights do not change.

Iteration 5

Input 1

Forward pass:
1 * 0 + 0 * 0.5 + 0 * 0.25 = 0
y = 0

Update weights:
(y - t) is zero since the correct output was 0, so the weights do not change.

By this point, all four inputs in a row have resulted in correct outputs without changing the weights, so the weights have converged.