1. What is the magnitude of $\vec{w} = [0.5, 0.5]^T$.

$$\sqrt{0.5^2 + 0.5^2} \approx \boxed{0.707}$$

2. Multiple the following two vectors $(\vec{x} \times \vec{w}^T)$ where $\vec{x} = [0.5, 0.5]$ and $\vec{w} = [0.75, 1.25]$

$$[0.5, 0.5] \cdot [0.75, 1.25] = 0.5(0.75) + 0.5(1.25)$$
$$= 0.375 + 0.625 = \boxed{1}$$

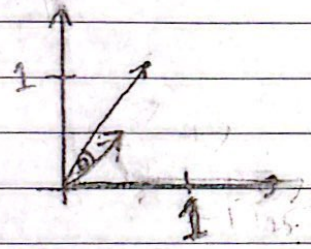
3. $(\vec{x}^T \times \vec{w})$

$$[0.5, 0.5] \cdot [0.75, 1.25] = \boxed{1}$$

4. $x \cdot y$

$$[0.5, 0.5] \cdot [0.75, 1.25] = 0.375 + 0.625 = \boxed{1}$$

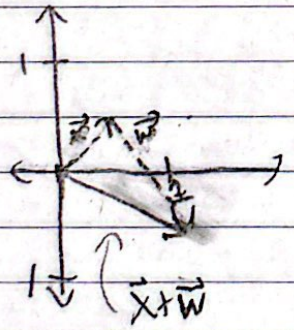
5.



$$|x| = \sqrt{0.5^2 + 0.5^2} \approx 0.707$$
$$|y| = \sqrt{0.75^2 + 1.25^2} \approx 1.461$$

$$\theta = \arccos\left(\frac{1}{|x||y|}\right) = 0.641 \text{ radians}$$
$$\approx 36.77^\circ$$

6.



$$\vec{x} + \vec{w} = [0.5 + 0.75, 0.5 + (-1)]$$
$$= [1.25, -0.5]$$

7. Prediction uses its trained model to predict the outcome when given specific values.
Classification uses its trained model to decide whether the input is of a specific group.

8. Find the weights to predict the "OR" function.
Initial weights: $w_0 = 0$, $w_1 = 0.5$, $w_2 = -0.5$
learning parameter: $r = 0.25$
$x_0 = 1$.

x_1	x_2	OR	Y_1	Correct?	new weights
0	0	0	$g(0+0+0) = 0$	✓	
0	1	1	$g(0+0+(-0.5)) = 0$	×	$w_0 = 0.25$, $w_1 = 0.5$, $w_2 = -0.25$
1	0	1	$g(0+0.5+0) = 1$	✓	
1	1	1	$g(0+0.5+(-0.5)) = 0$	×	$w_0 = 0.5$, $w_1 = 0.75$, $w_2 = 0$

new weights
$W_0 = 0 - 0.25(0-1)(1) = 0.25$
$w_1 = 0.5 - 0.25(0-1)(0) = 0.5$
$w_2 = -0.5 - 0.25(0-1)(1) = -0.25$
↓
$w_0 = 0.25 - 0.25(0-1)(1) = 0.5$
$w_1 = 0.5 - 0.25(0-1)(1) = 0.75$
$w_2 = -0.25 - 0.25(0-1)(1) = 0$

x_1	x_2	t_1	Y_1	Correct?	new weights
0	0	0	$g(0.5+0+0) = 1$	✗	$w_0 = 0.25$, $w_1 = 0.75$, $w_2 = 0$
0	1	1	$g(0.5+0+0) = 1$	✓	
1	0	1	$g(0.5+0.75+0) = 1$	✓	
1	1	1	$g(0.5+0.75+0) = 1$	✓	

8 (cont.)

new weights

$w_0 = 0,5 - 0,25(1-0)(1) = 0,25$

$w_1 = 0,75 - 0,25(1-0)(0) = 0,75$

$w_2 = 0 - 0,25(1-0)(0) = 0$

x_1	x_2	t_1	Y_1	correct?	new weights
0	0	0	$g(0.25+0+0) = 1$	✗	$w_0 = 0,\ w_1 = 0,75,\ w_2 = 0$
0	1	1	$g(0,75+0+0) = 1$	✓	
1	0	1	$g(0,25+0,75+0) = 1$	✓	
1	1	1	$g(0,25+0,75+0) = 1$	✓	

New weights

$w_0 = 0,25 - 0,25(1-0)(1) = 0$

$w_1 = 0,75 - 0,25(1-0)(0) = 0,75$

$w_2 = 0 - 0,25(1-0)(0) = 0$

x_1	x_2	t_1	Y_1	correct?	new weights
0	0	0	$g(0+0+0) = 0$	✓	
0	1	1	$g(0+0+0) = 0$	✗	$w_0 = 0.25, w_1 = 0,75, w_2 = 0,25$
1	0	1	$g(0+0,75+0) = 1$	✓	
1	1	1	$g(0+0,75+0) = 1$	✓	

$w_0 = 0 - 0,25(0-1)(1) = 0,25$

$w_1 = 0,75 - 0,25(0-1)(0) = 0,75$

$w_2 = 0 - 0,25(0-1)(1) = 0,25$

8 (cont.) $w_0 = 0.25,\ w_1 = 0.75,\ w_2 = 0.25$

x_1	x_2	t_1	y_1	correct?	new weights
0	0	0	$g(0.25 + 0 + 0) = 1$	X	$w_0 = 0,\ w_1 = 0.75,\ w_2 = 0.25$
0	1	1	$g(0.25 + 0 + 0.25) = 1$	✓	
1	0	1	$g(0.25 + 0.75 + 0) = 1$	✓	
1	1	1	$g(0.25 + 0.75 + 0.25) = 1$	✓	

$w_0 = 0.25 - 0.25(1-0)(1) = 0$
$w_1 = 0.75 - 0.25(1-0)(0) = 0.75$
$w_2 = 0.25 - 0.25(1-0)(0) = 0.25$

x_1	x_2	t_1	y_1	correct?
0	0	0	$g(0 + 0 + 0) = 0$	✓
0	1	1	$g(0 + 0 + 0.25) = 1$	✓
1	0	1	$g(0 + 0.75 + 0) = 1$	✓
1	1	1	$g(0 + 0.75 + 0.25) = 1$	✓

$w_0 = 0$
$w_1 = 0.75$
$w_2 = 0.25$