

**Cerebrals Society International Contest 2009**

**2-Parameters Logistic Model**

**Item Characteristic Curves**

Xavier Jouve

The data collected from the first 243 subjects has been used in order to analyse the psychometric validity of each item. The first assumption that has been made is to draw the Item Characteristic Curves (ICC) using the 2-Parameters Logistic Model (2PLM) as developed by Birnbaum (1968). The first parameter is the discrimination parameter referred to with letter  $a$ , which is proportional to the slope of the ICC at the ability scale point  $b$ , the second parameter, also called the difficulty parameter. This model is the generalization of the 1-Parameter Logistic Model (1PLM) firstly introduced by Rasch (1960), which only takes into account the item difficulty as given by the  $b$ -parameter. There also exists a model that includes a third parameter for guessing, called  $c$ -parameter. However, according to Hambleton, Swaminathan, & Jane Rogers (1991) this 3-Parameters Logistic Model (3PLM) is only applicable for multiple-choice items, because on free-response items like those of the Contest, the assumption of no guessing is quite probable and thus the model does not require the  $c$ -parameter.

The ICC for each of the Contest's hundred items relatively to their respective subtest, are all shown in Figures 1 to 100. These curves are the Item Response Functions (IRF) and could eventually be used in order select, discard or revised questions with unsatisfactory properties. Test items must be those with steeper slopes because they are more useful to separate the subjects into different ability levels. This results in a high  $a$ -parameter value.

The parameters have been estimated with NOHARM (Fraser & McDonald, 1988). This Item Response Theory (IRT) parameter estimation uses the Least Squares procedure to estimate parameters. The theta ( $\theta$ ) scale that represents ability was sectioned into sixteen equally spaced intervals of .5, ranging from -4 to 4. The midpoints of each interval were -3.75, -3.25, -2.75, -2.25, -1.75, -1.25, -.75, -.25, .25, .75, 1.25, 1.75, 2.25, 2.75, 3.25 and 3.75.

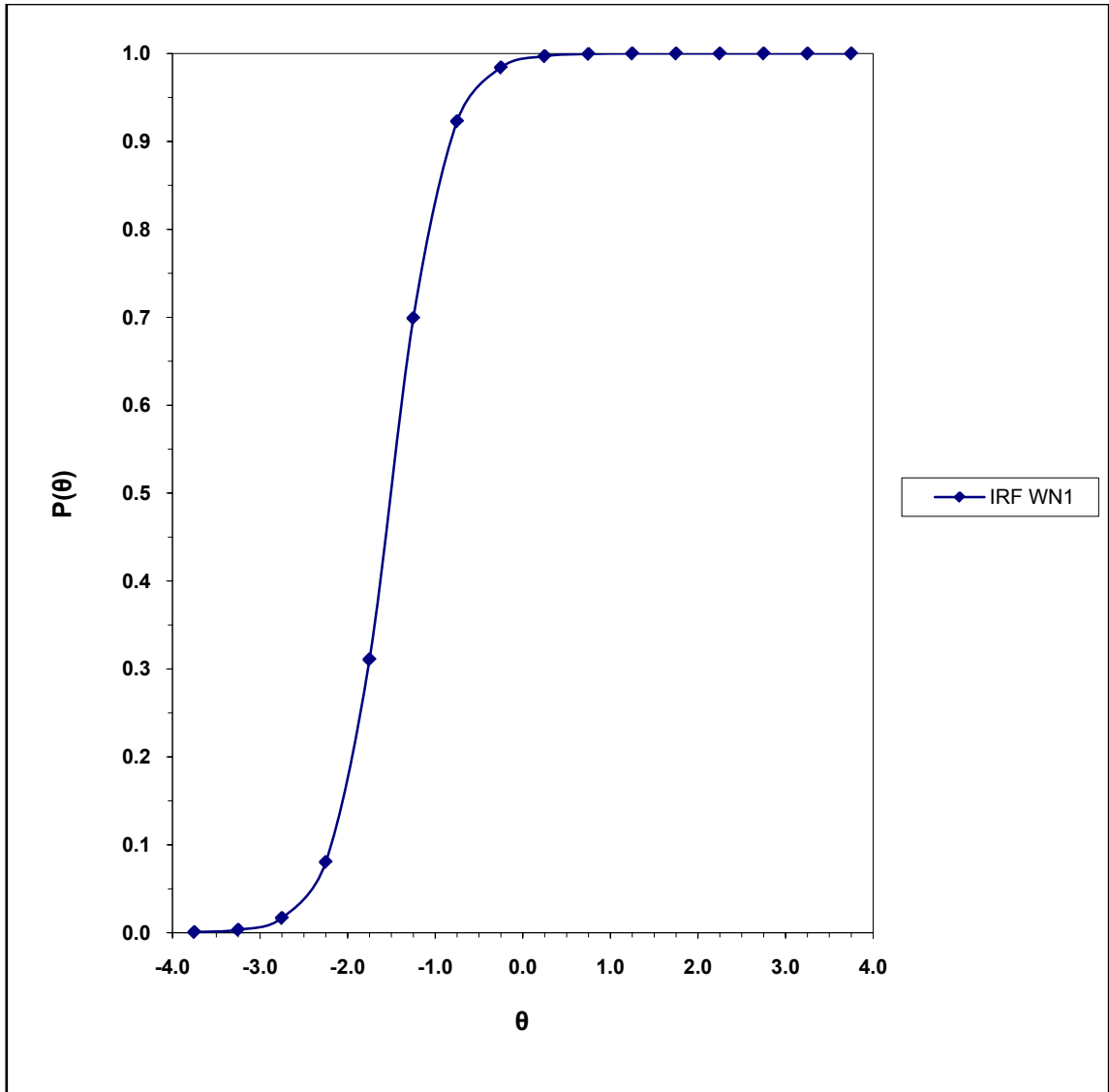


Figure 1 - Fit Plot for Item 1

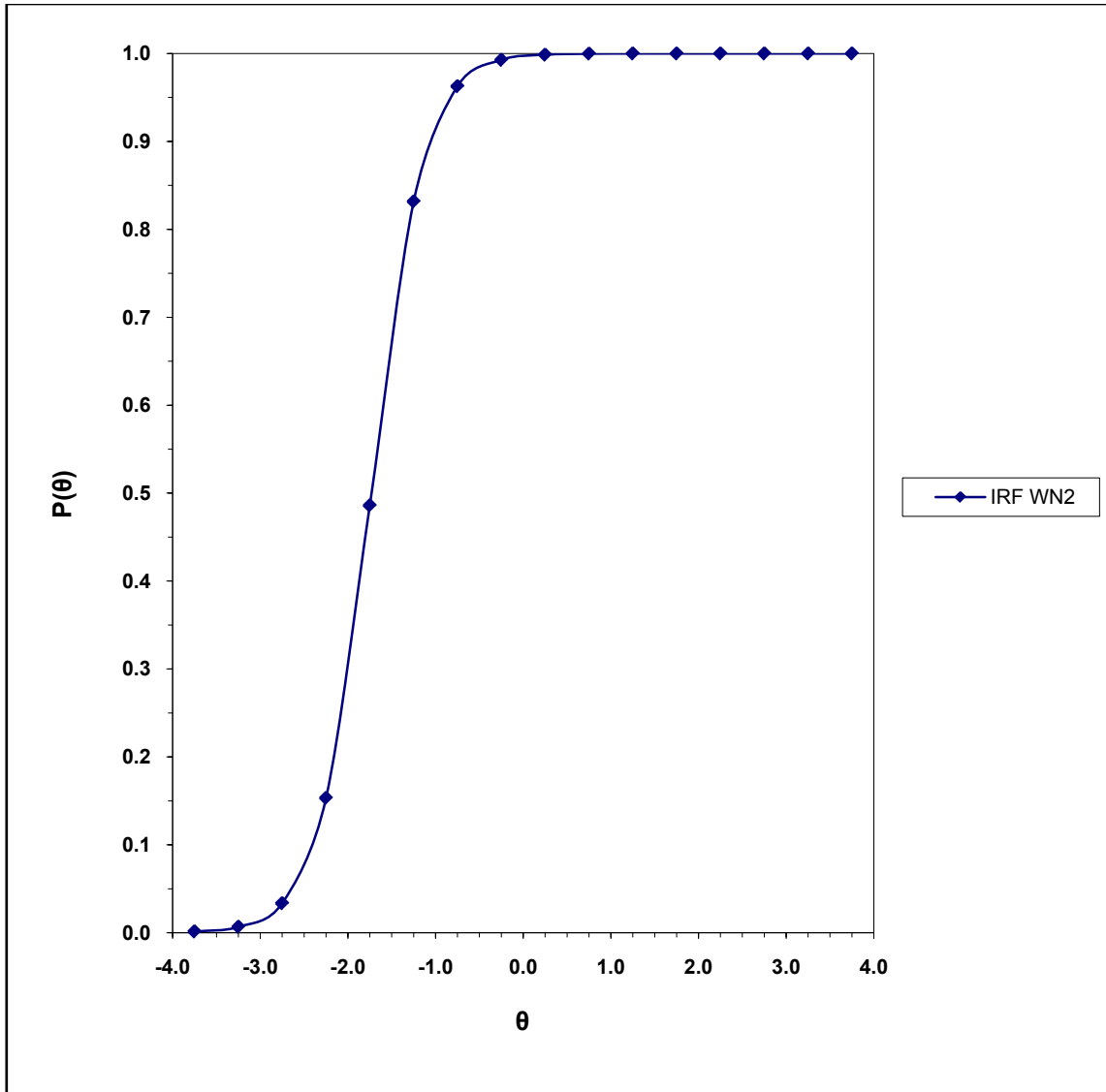


Figure 2 - Fit Plot for Item 2

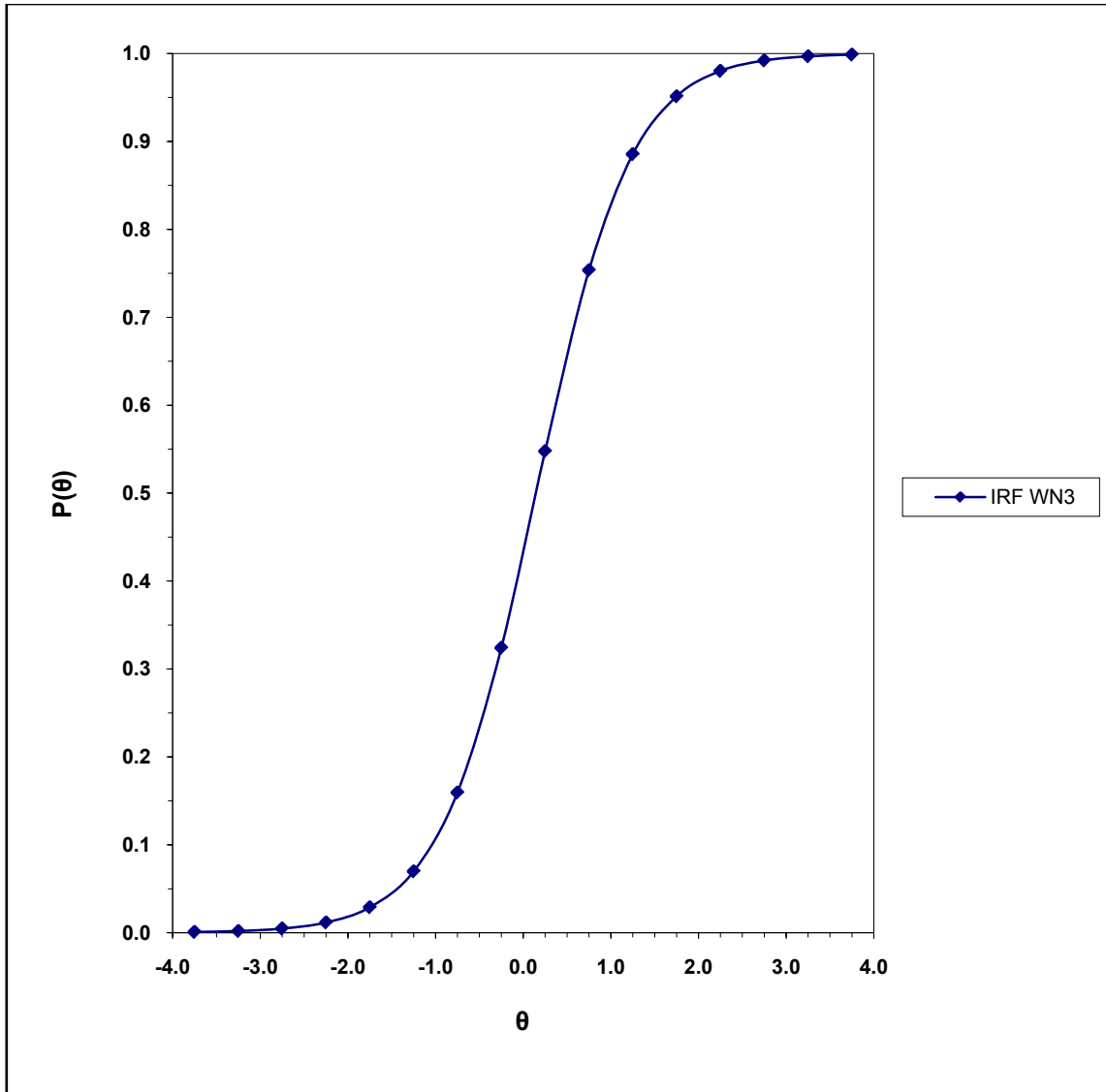


Figure 3 - Fit Plot for Item 3

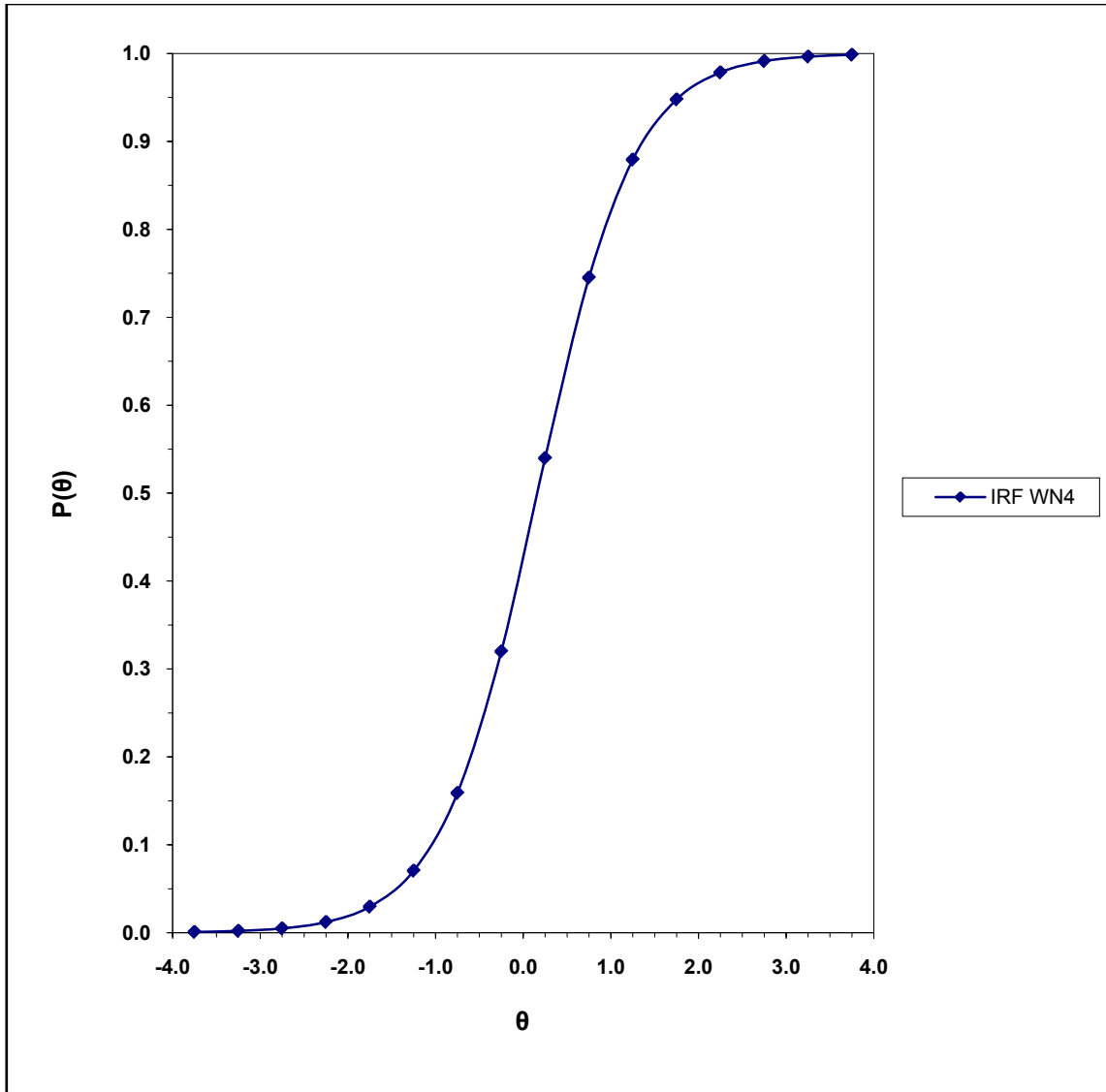


Figure 4 - Fit Plot for Item 4

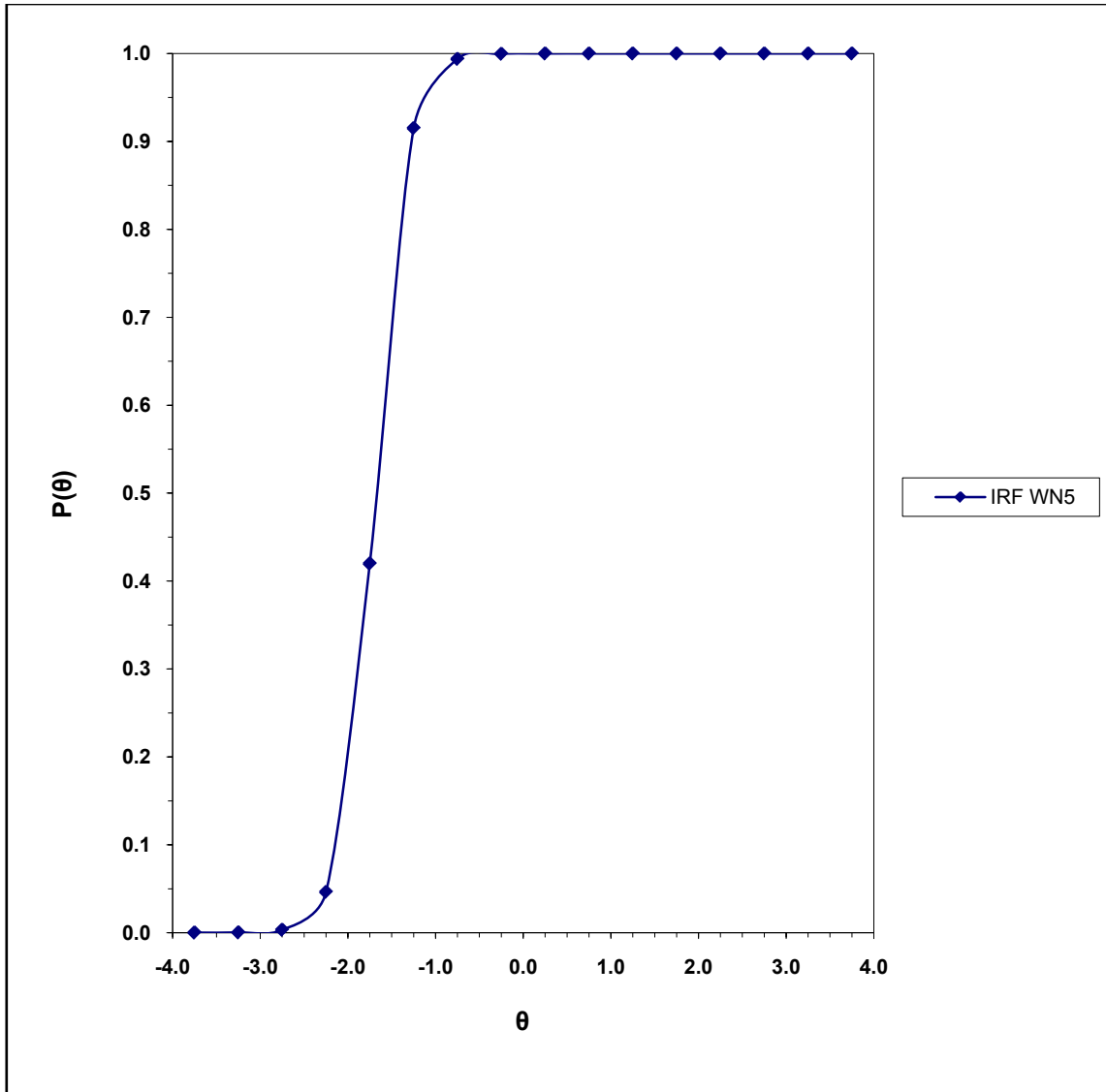


Figure 5 - Fit Plot for Item 5

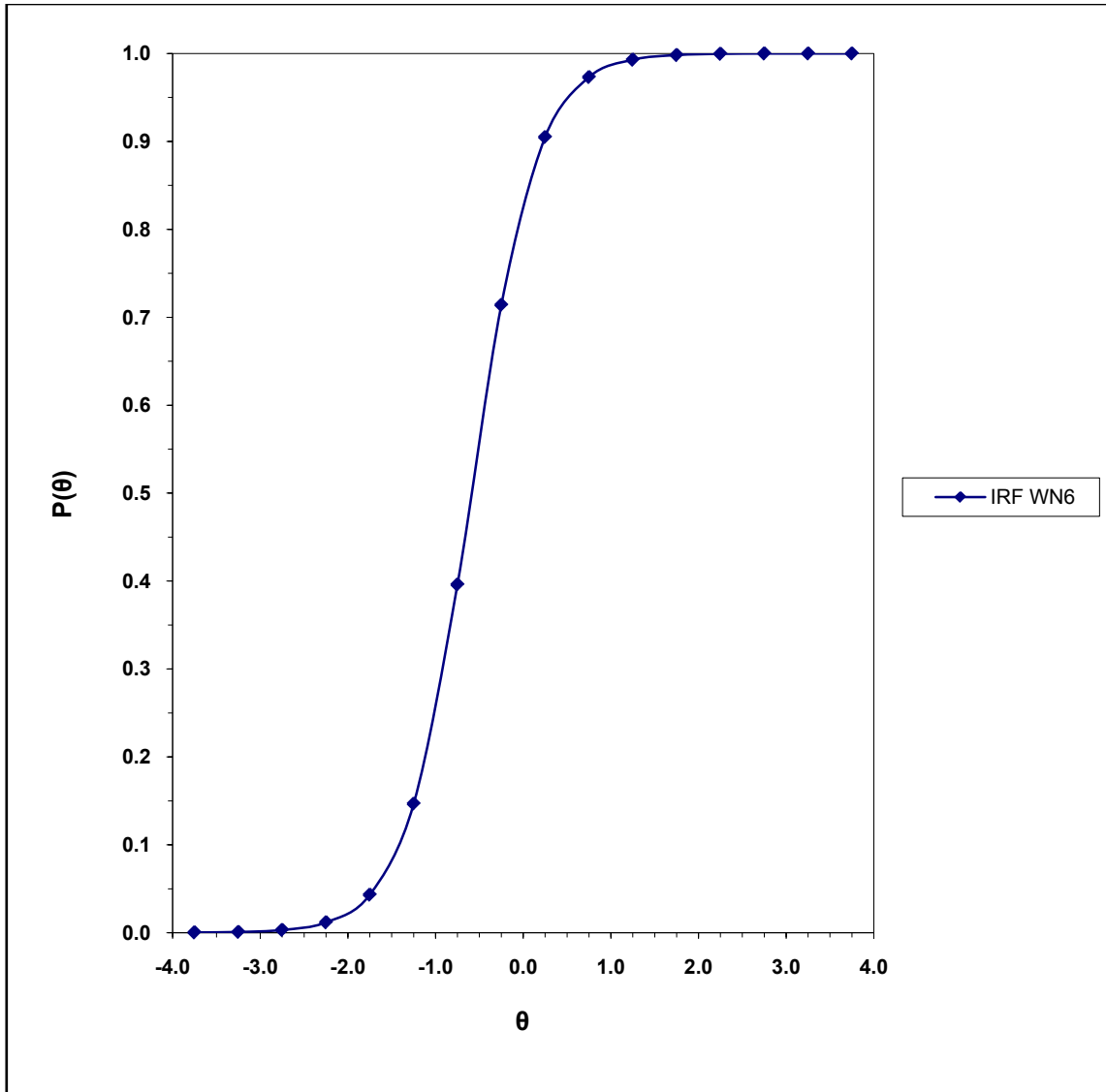


Figure 6 - Fit Plot for Item 6

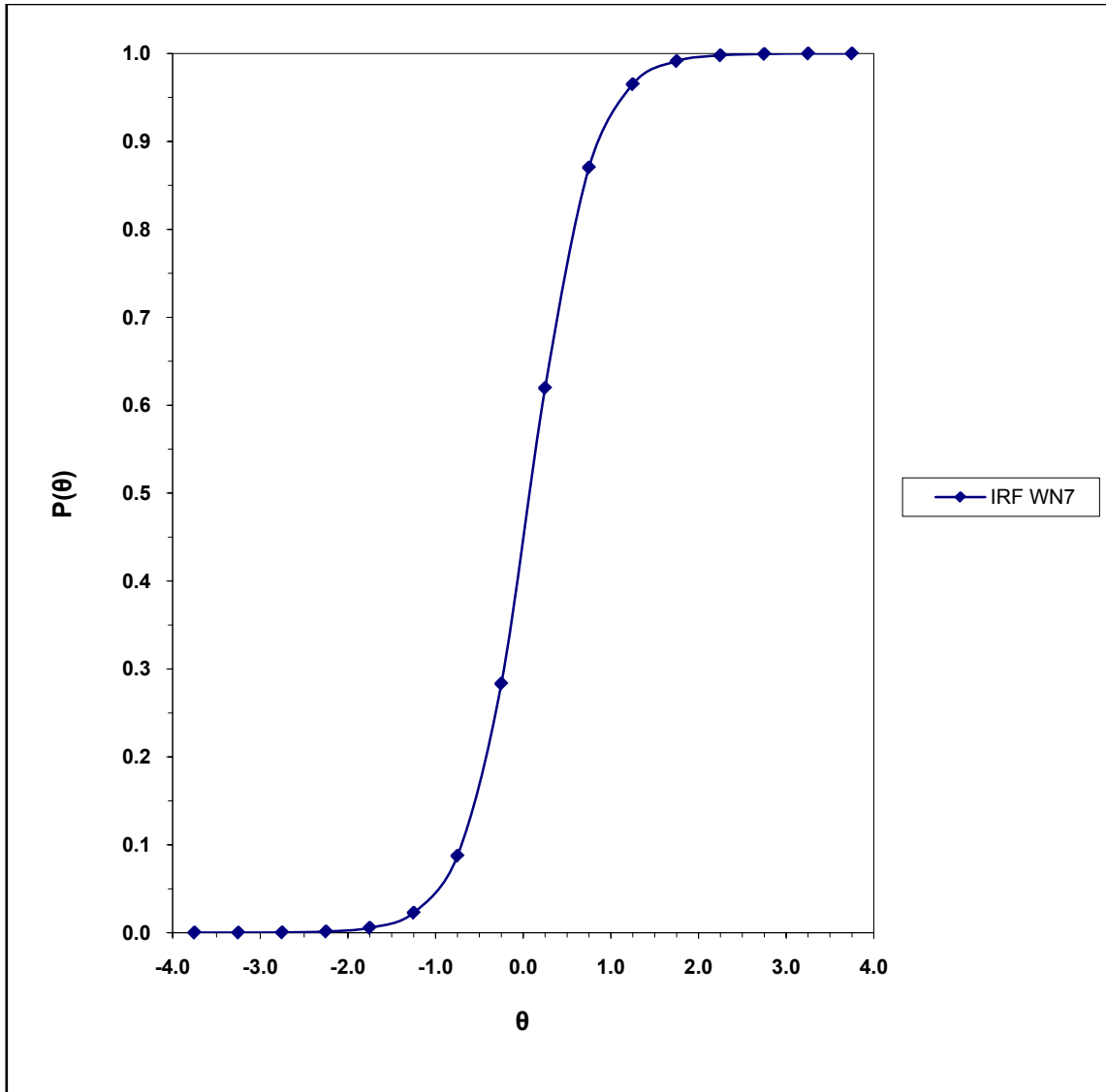


Figure 7 - Fit Plot for Item 7

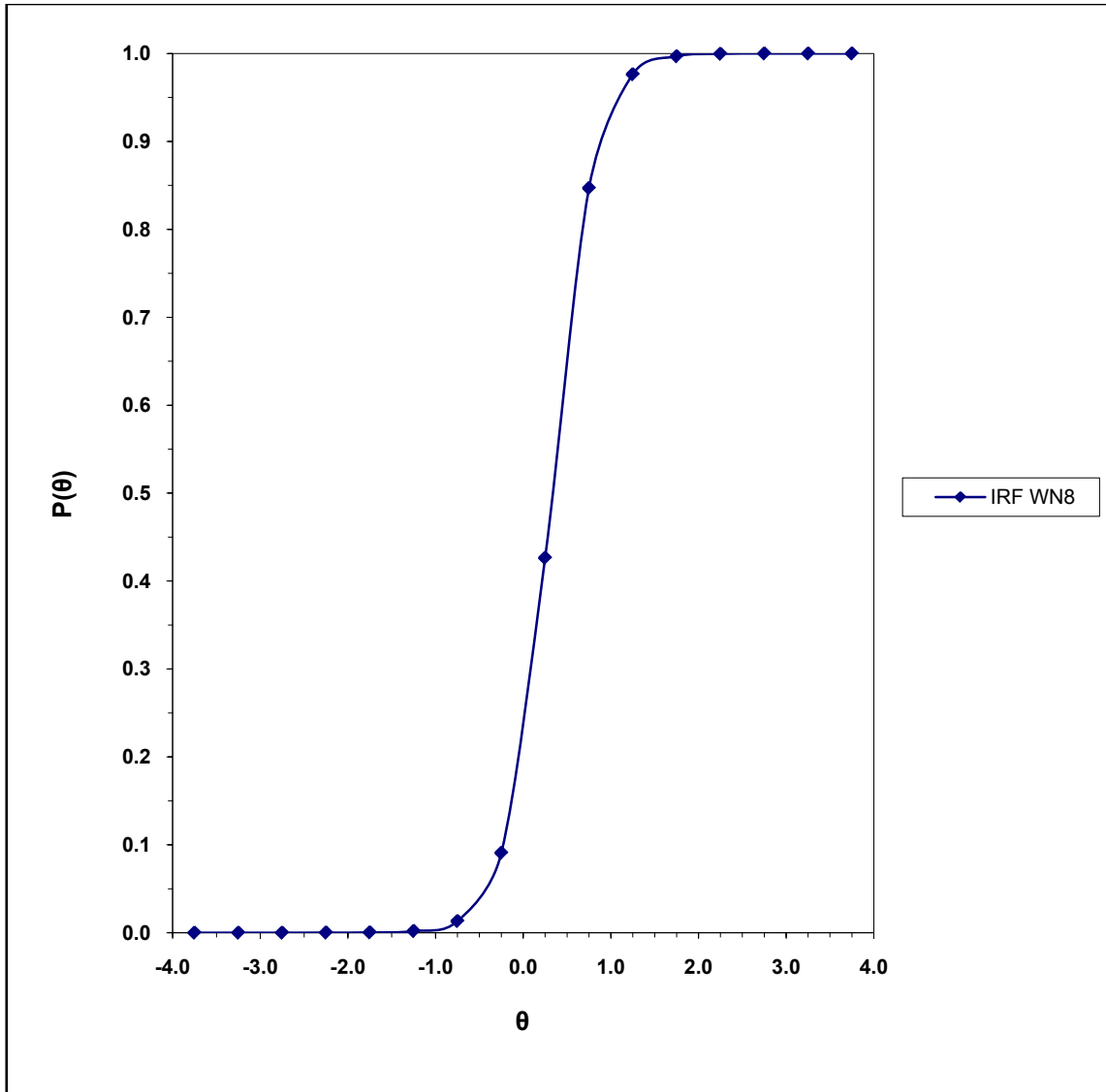


Figure 8 - Fit Plot for Item 8

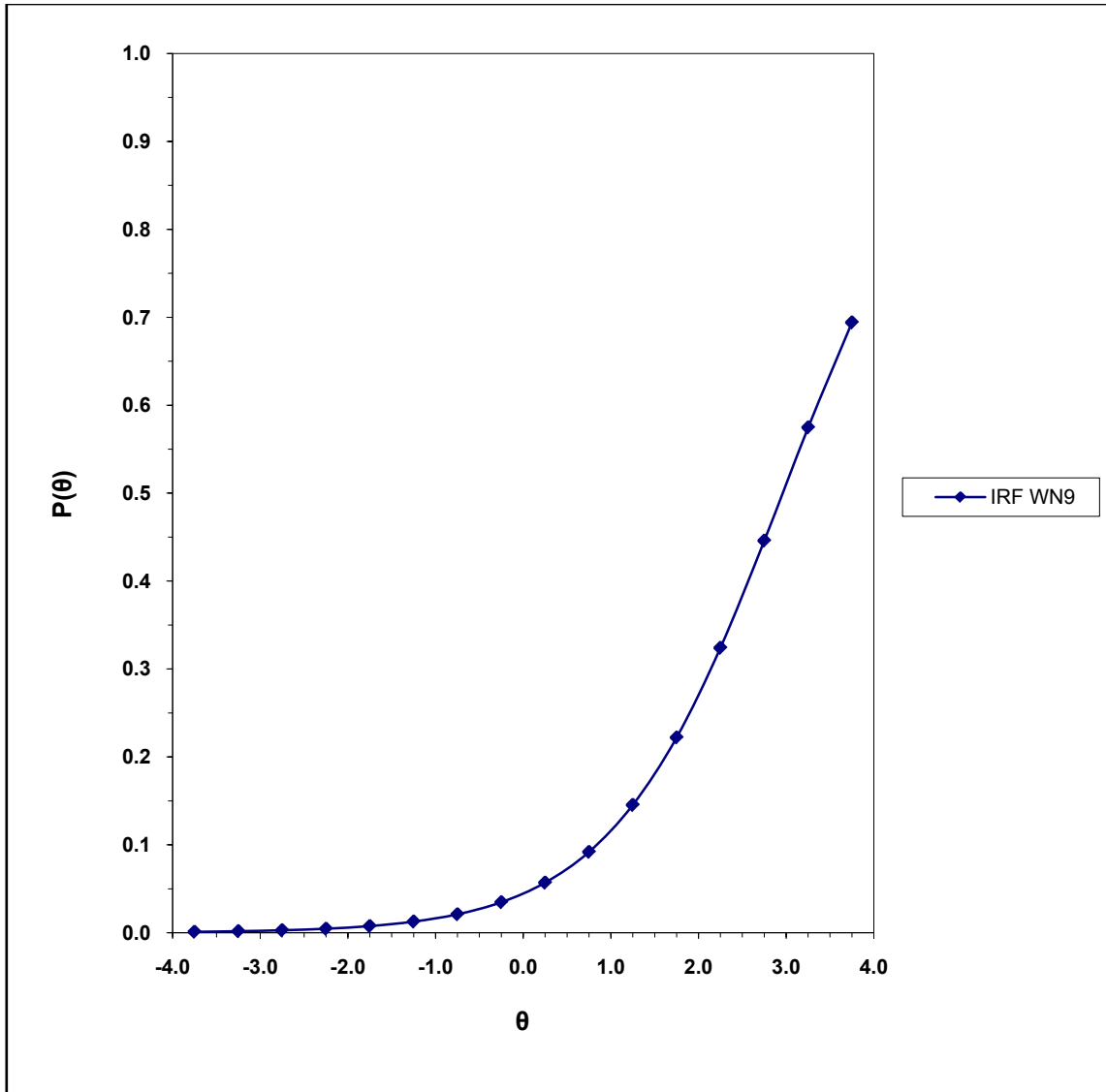


Figure 9 - Fit Plot for Item 9

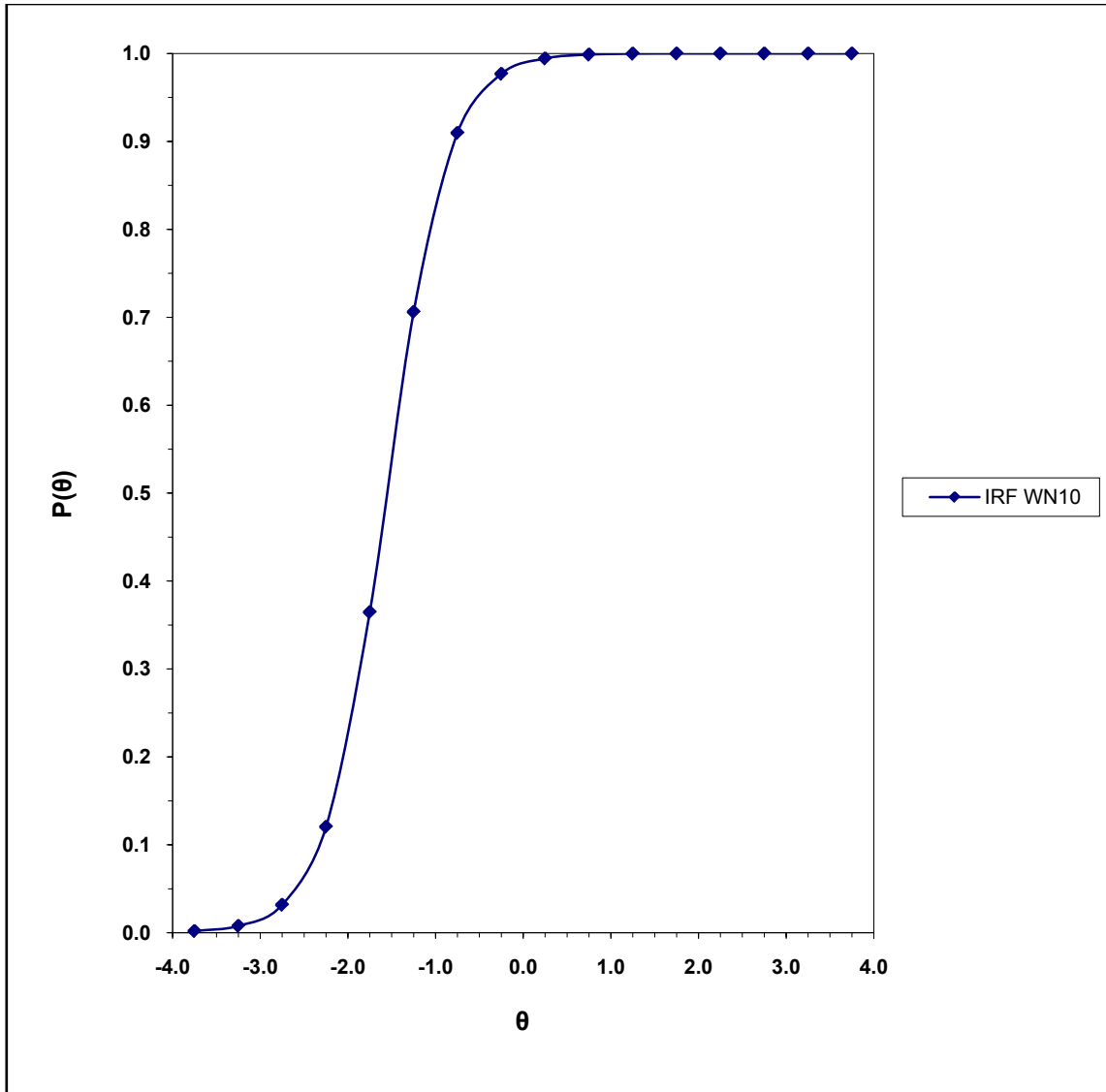


Figure 10 - Fit Plot for Item 10

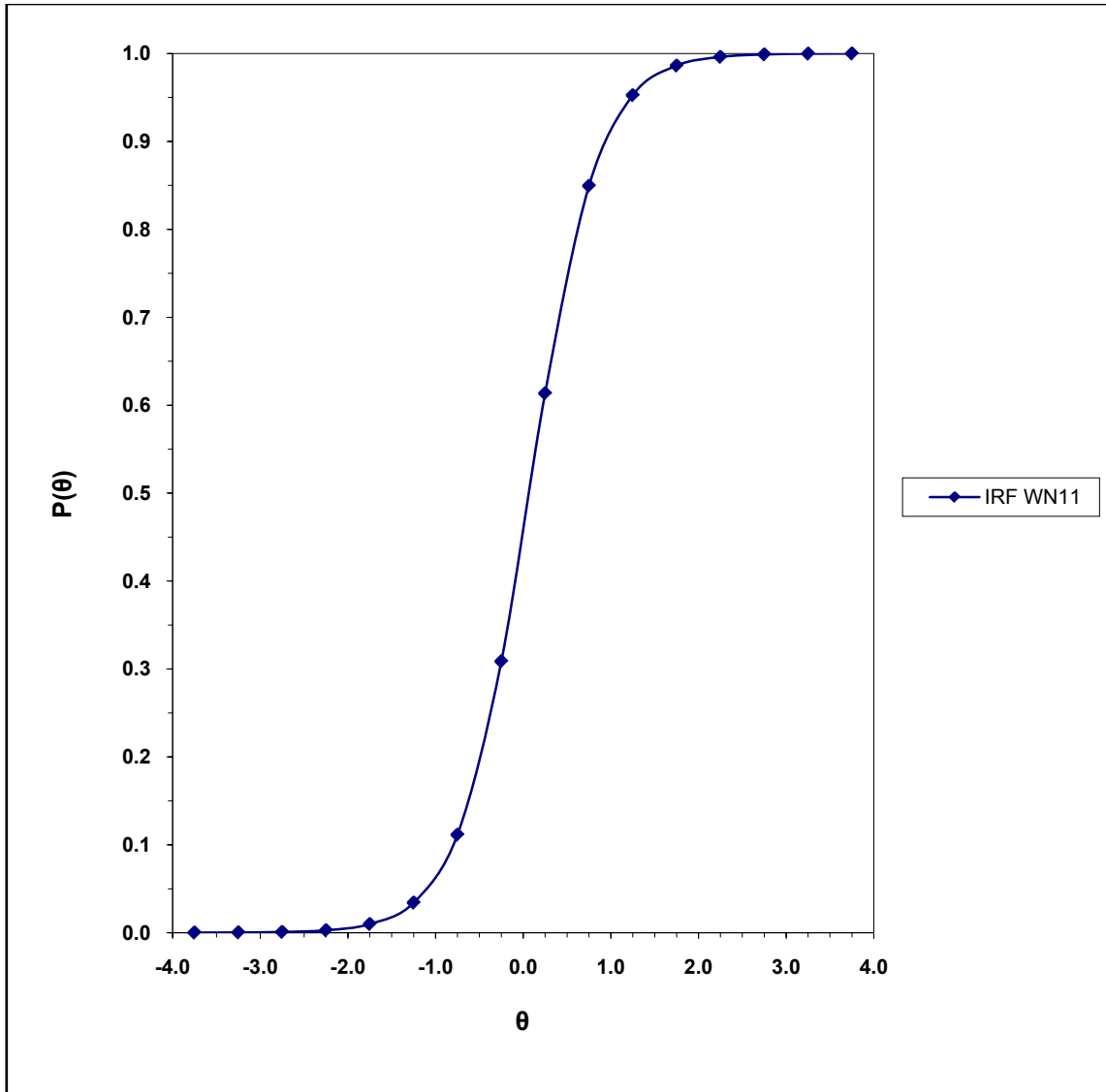


Figure 11 - Fit Plot for Item 11

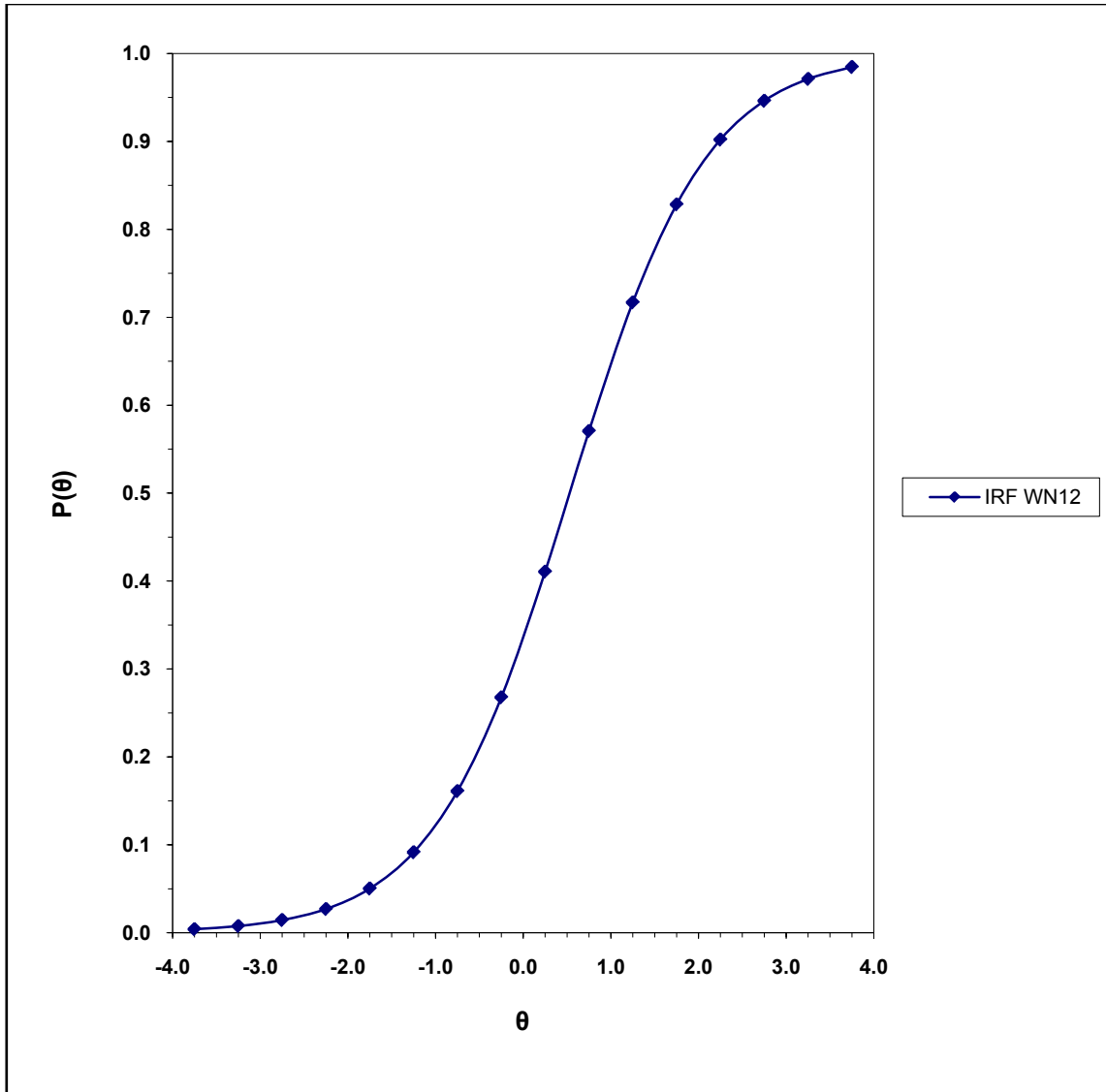


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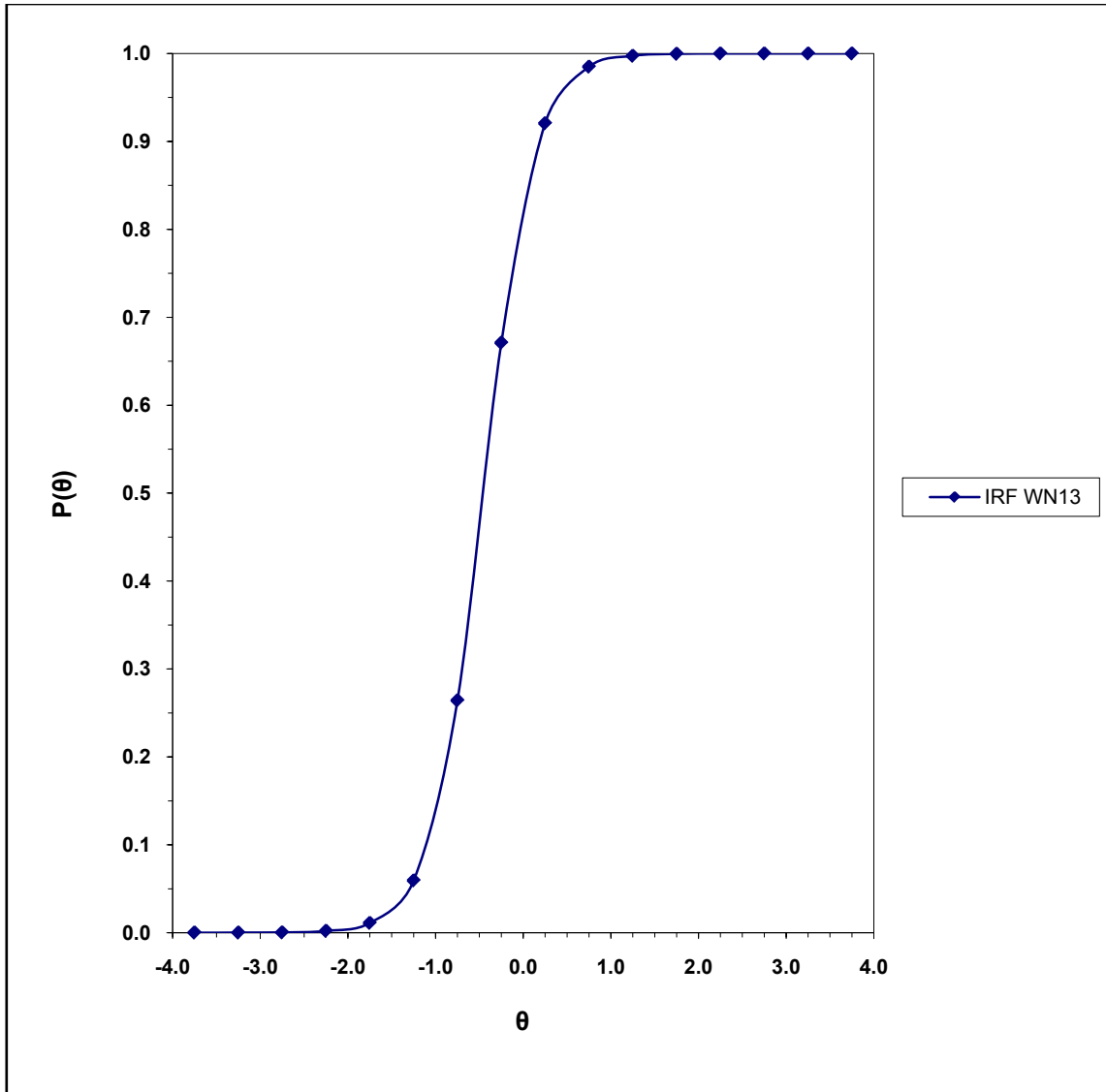


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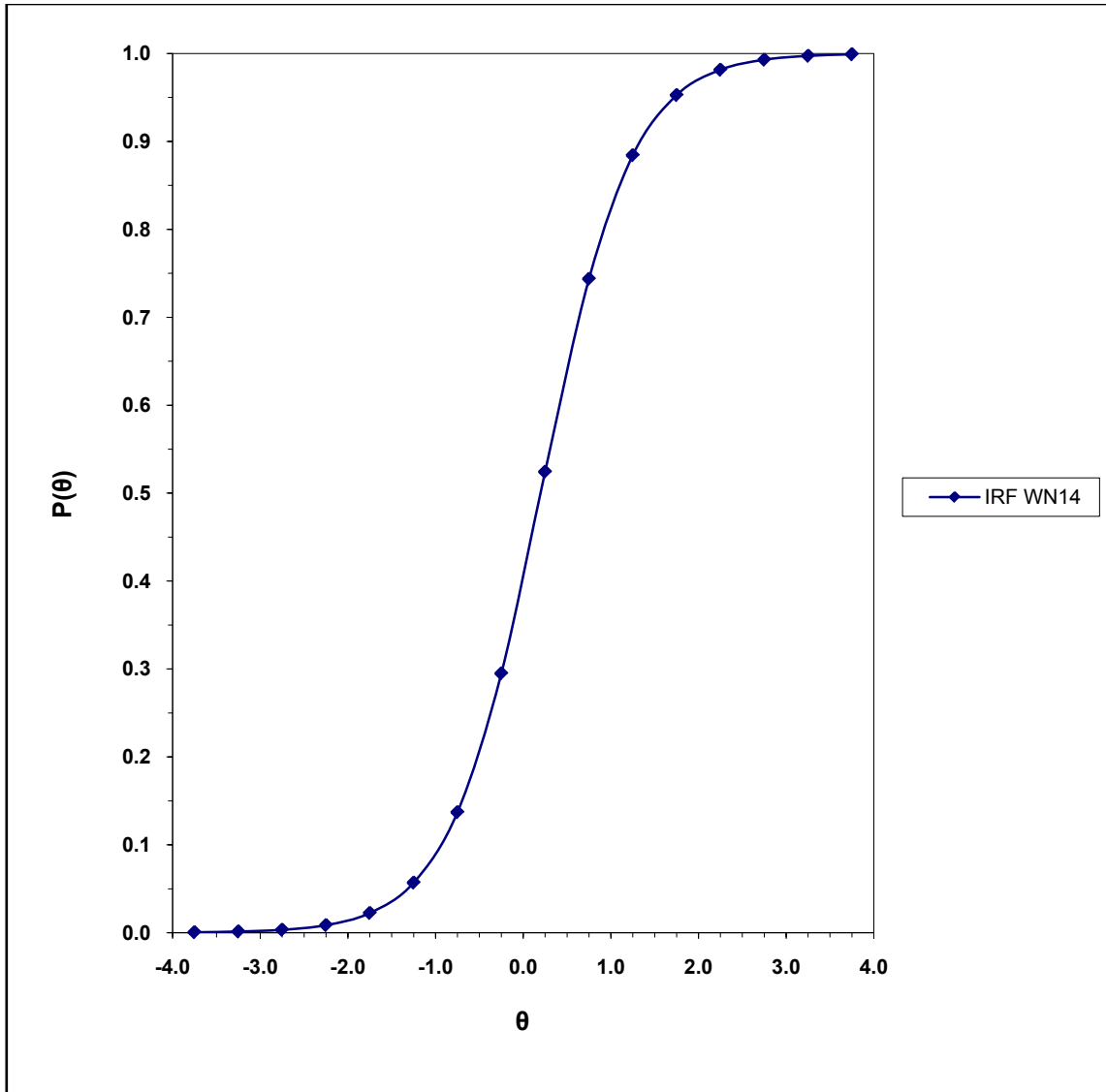


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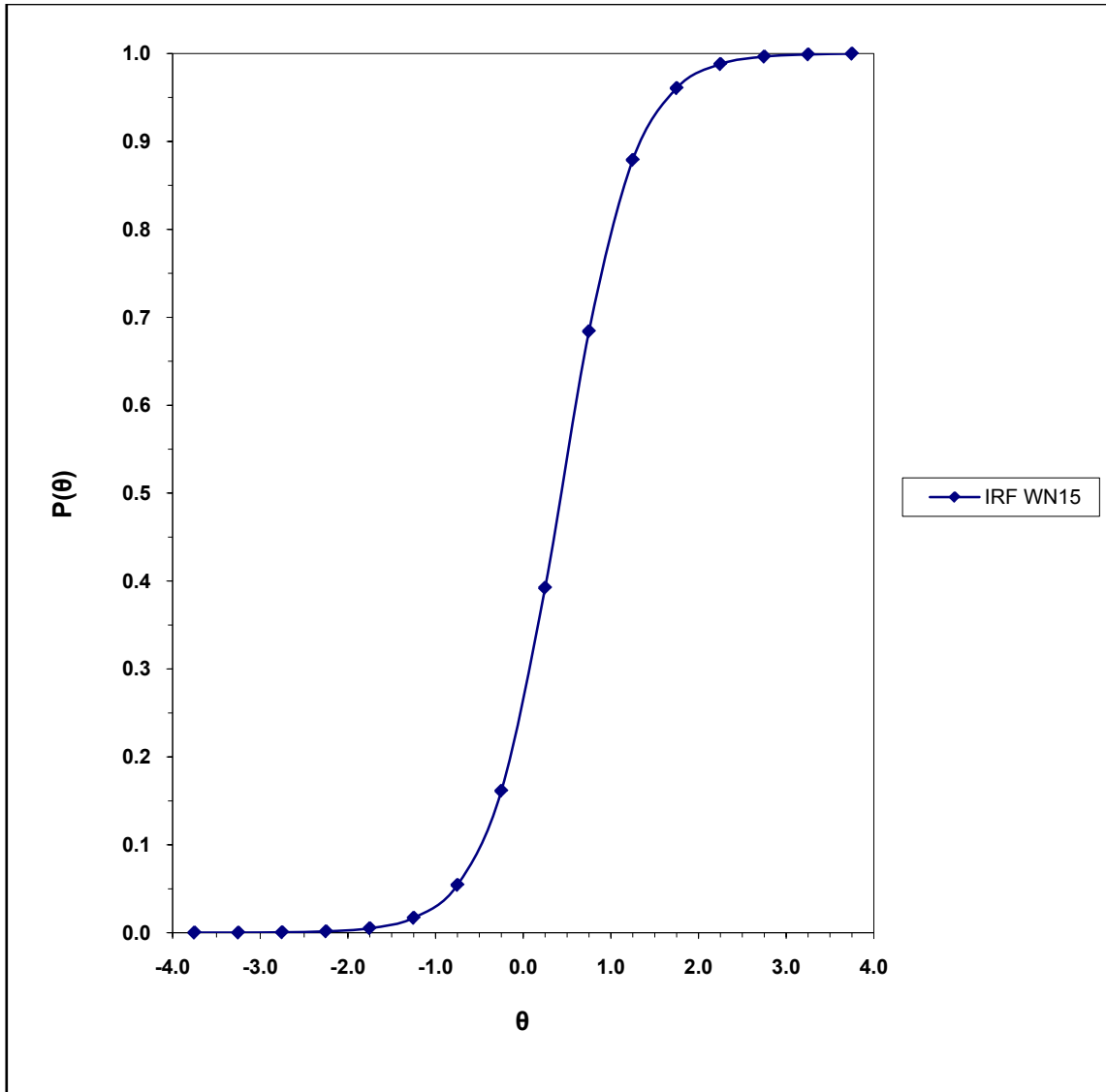


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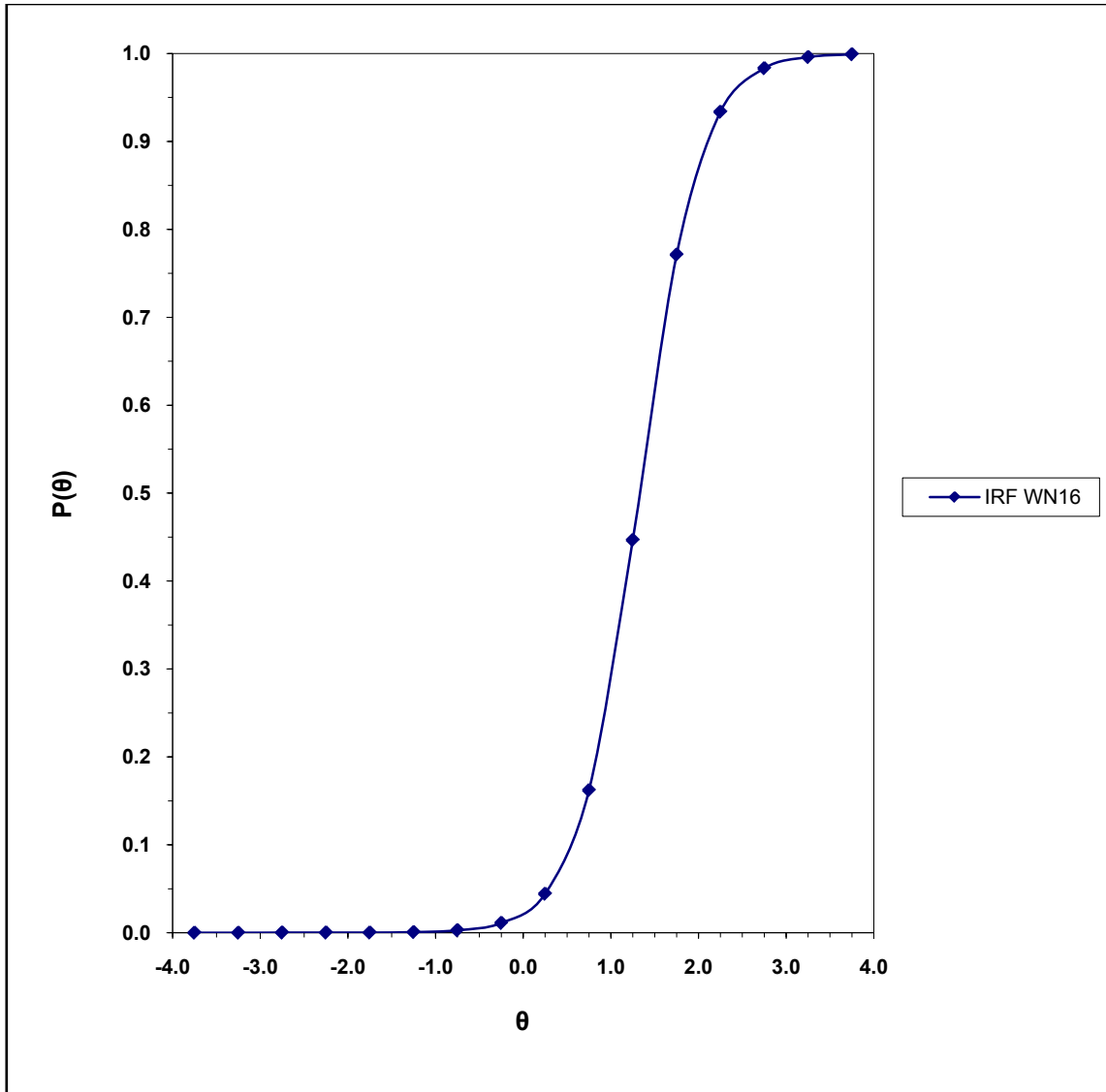


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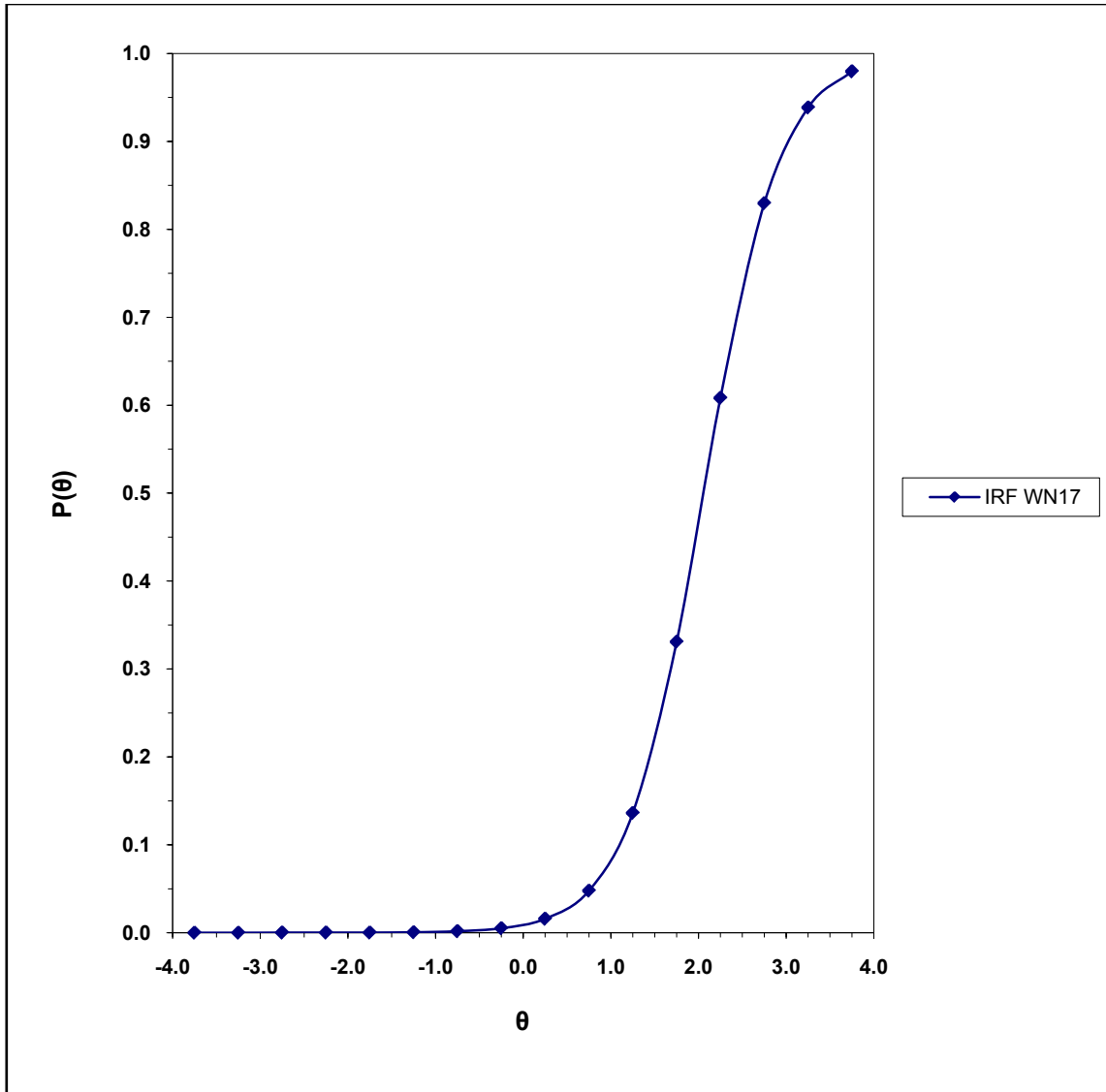


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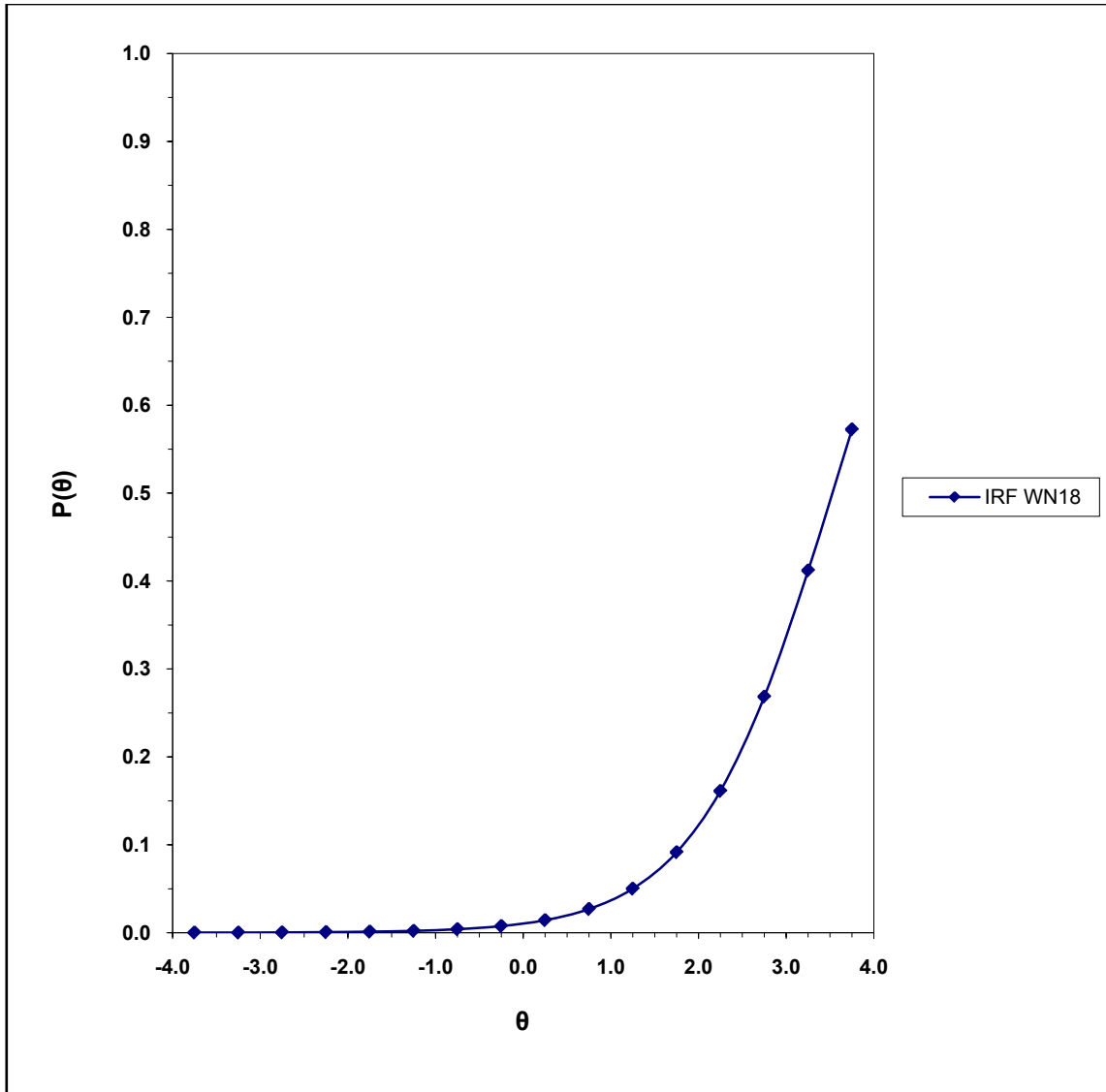


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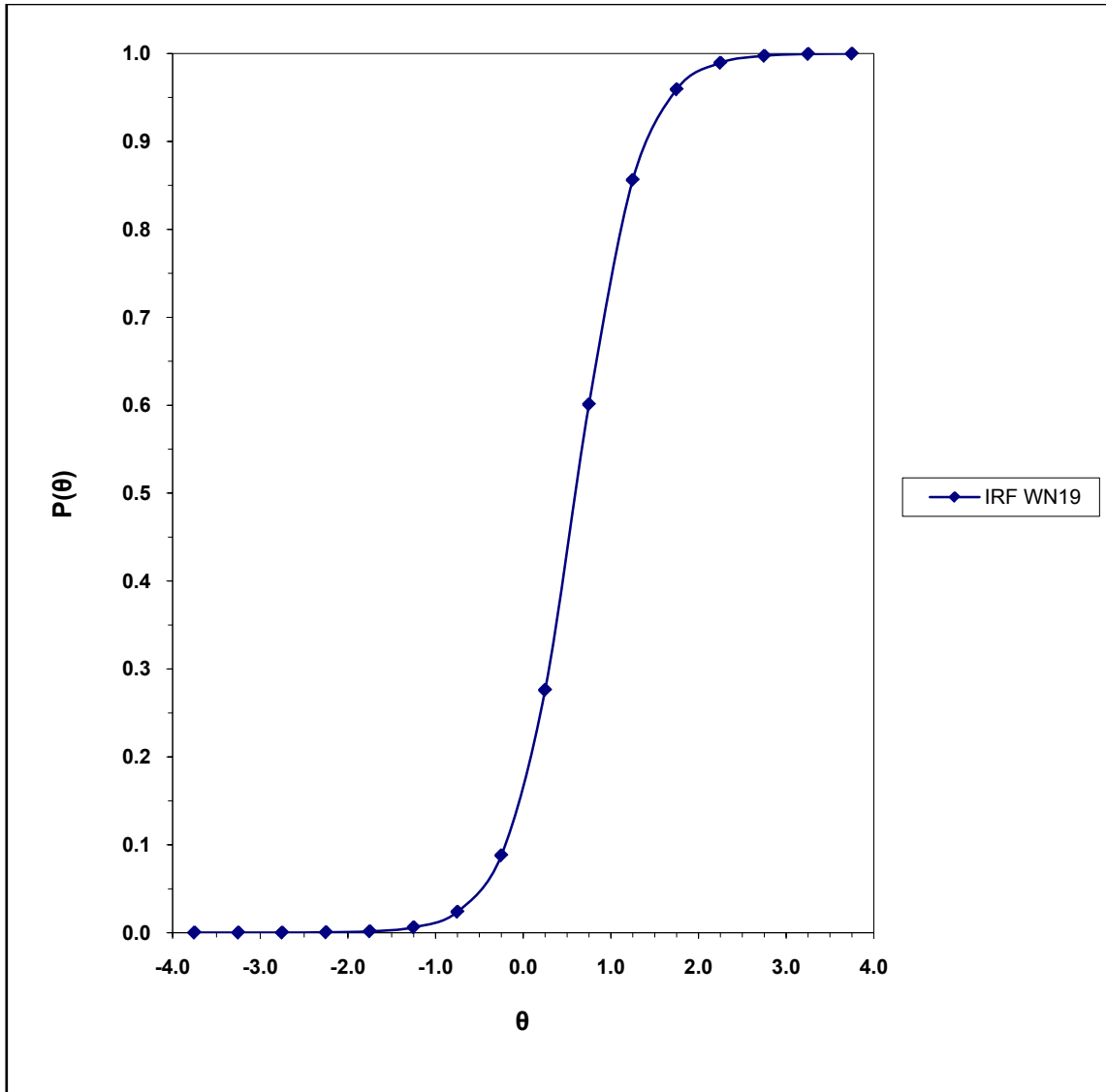


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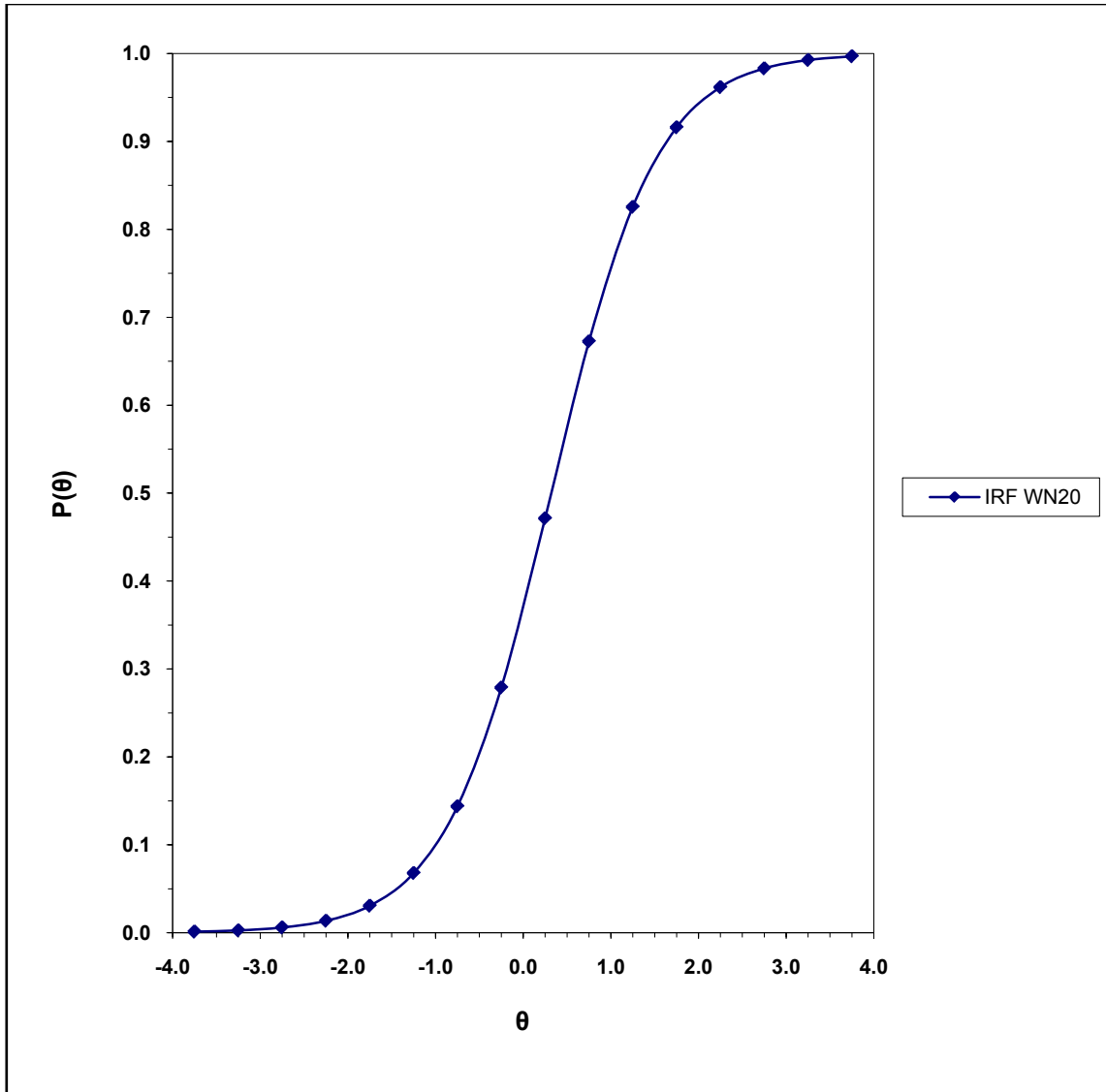


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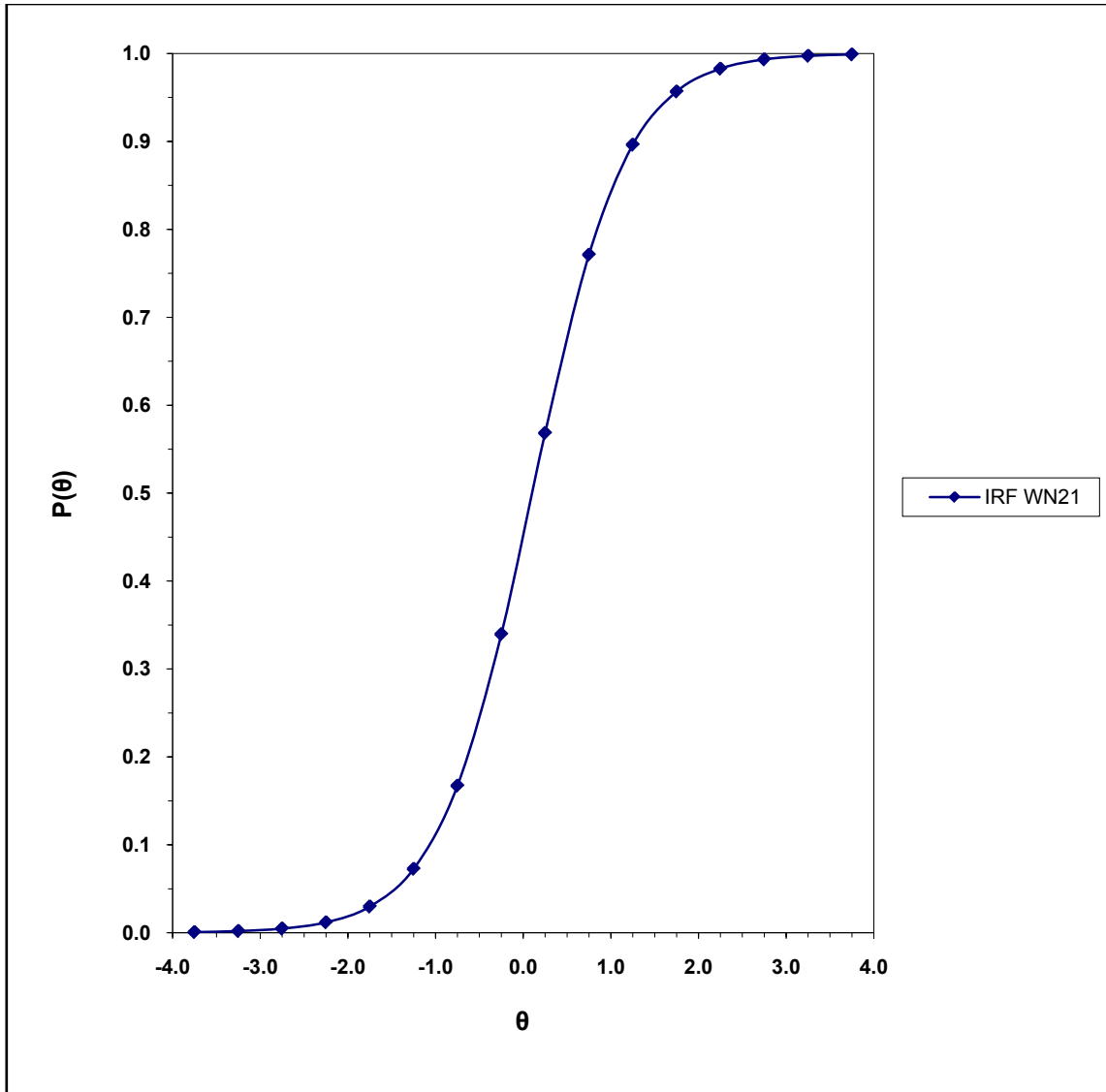


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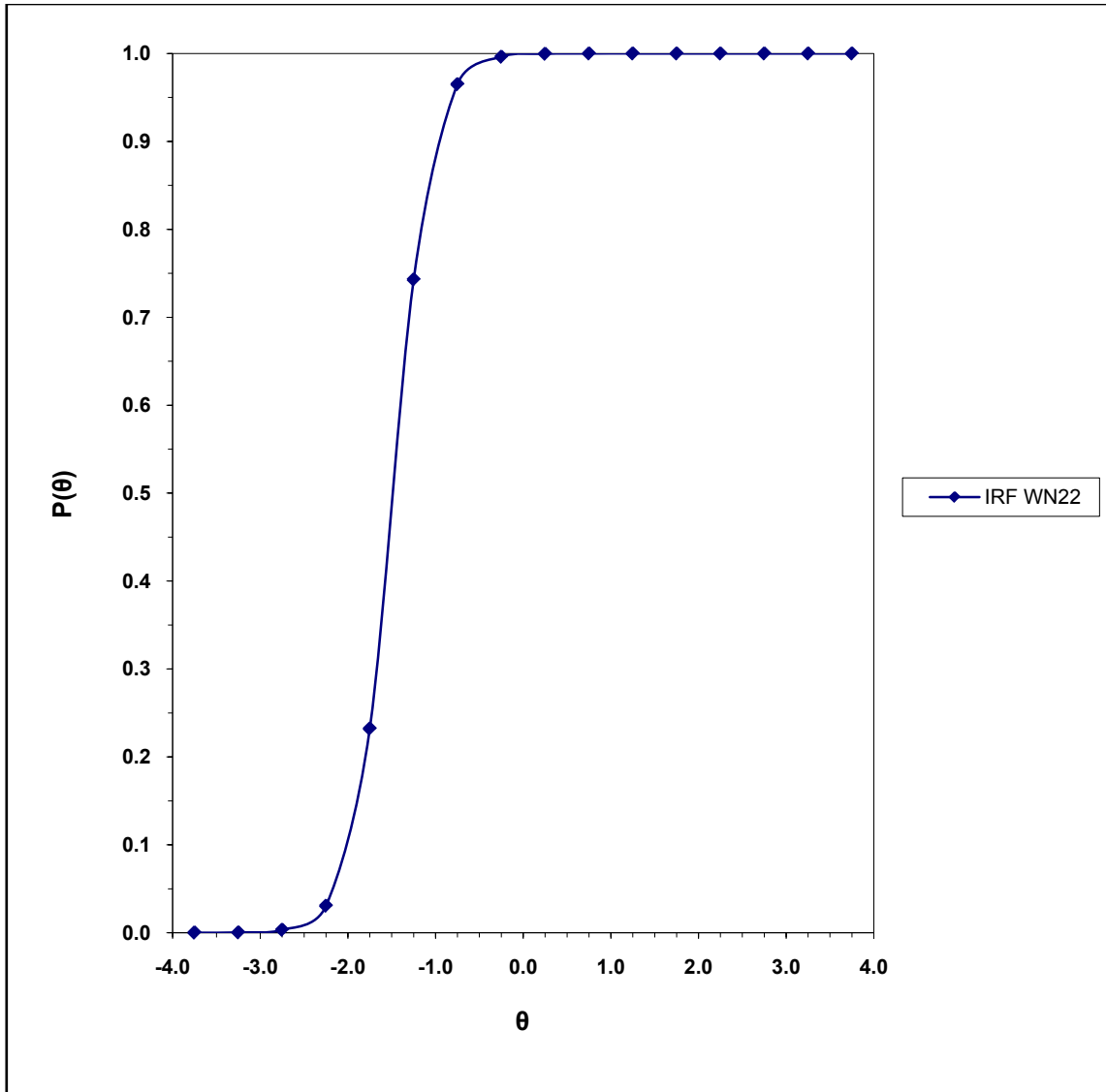


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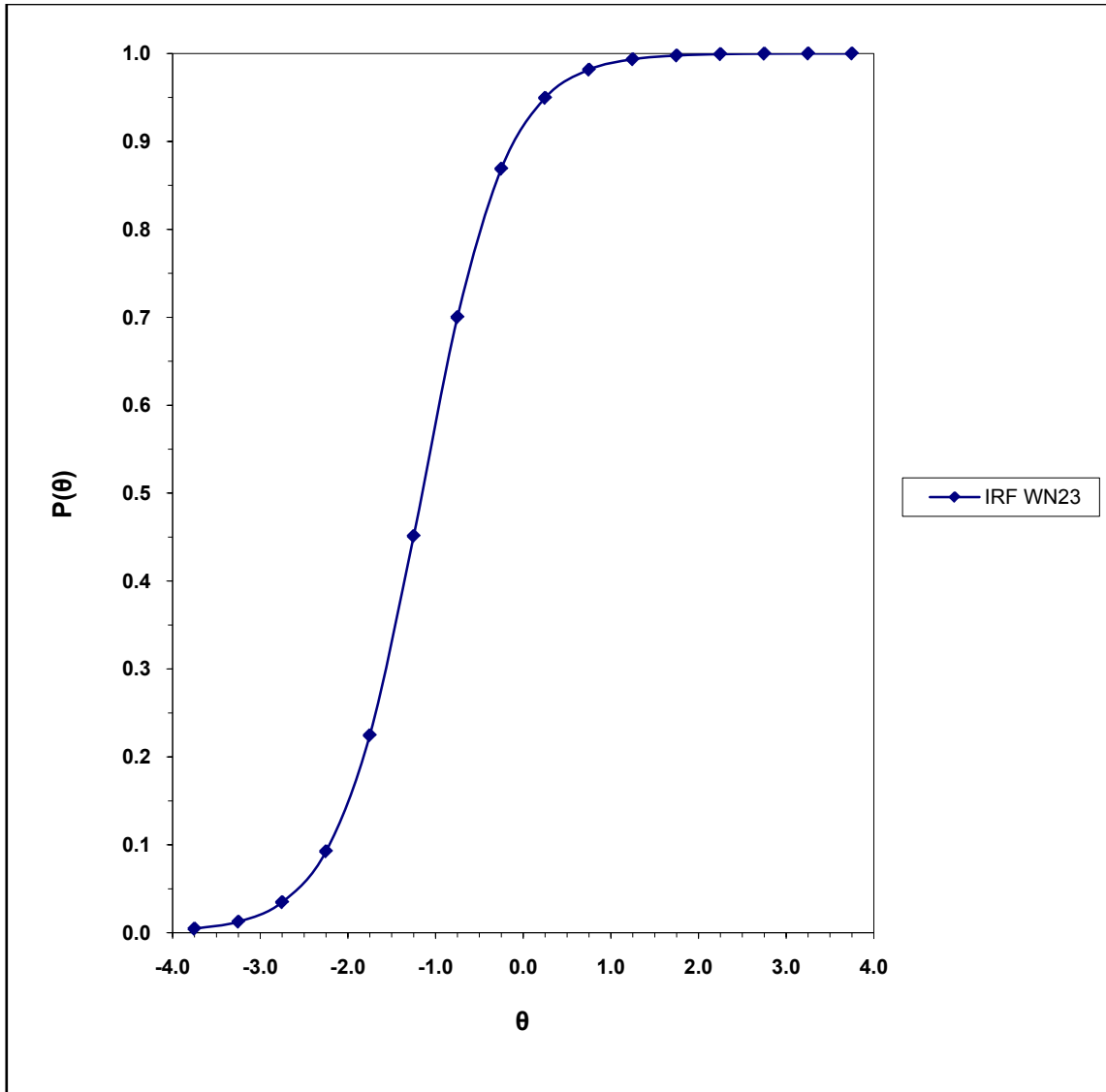


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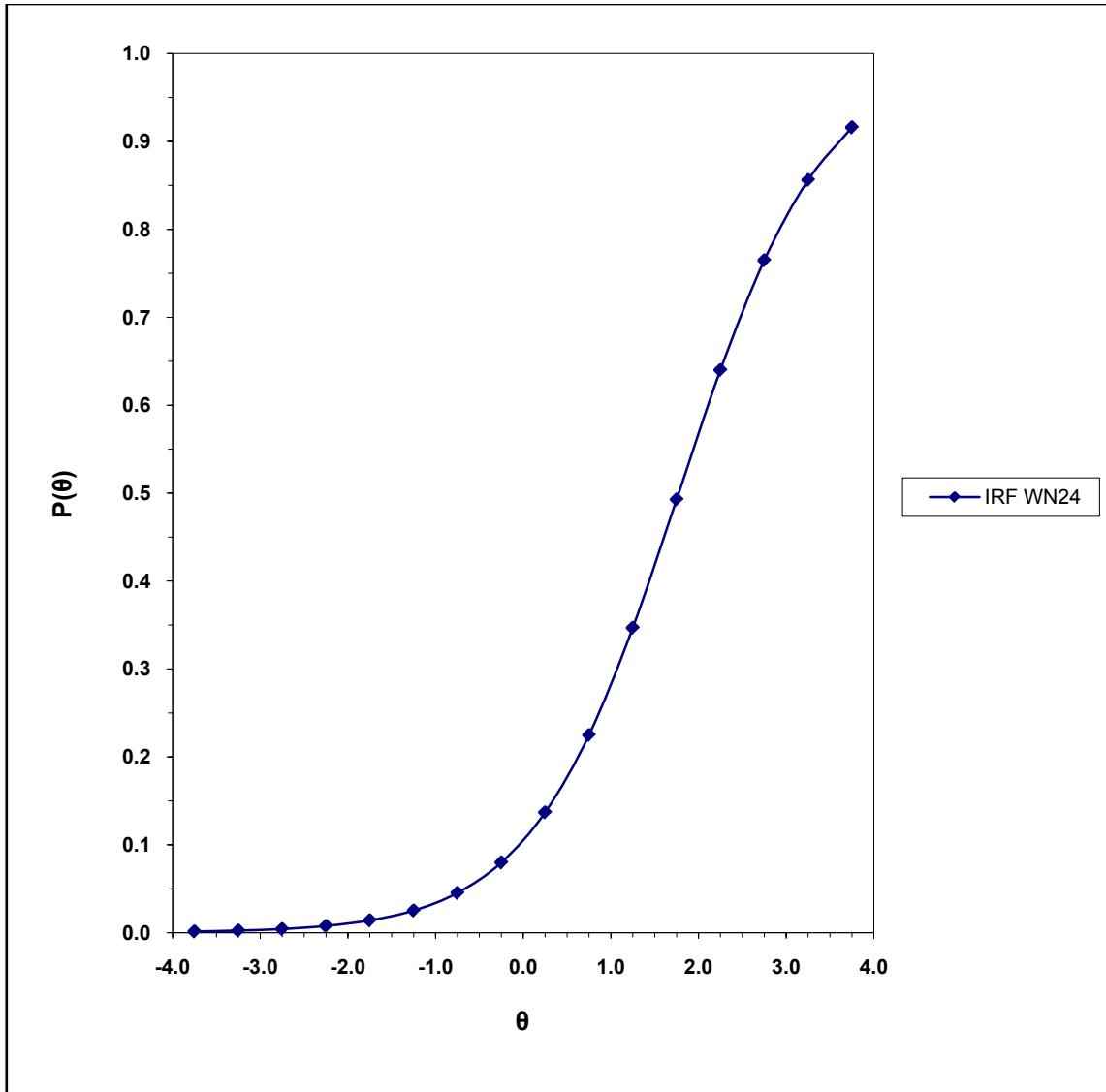


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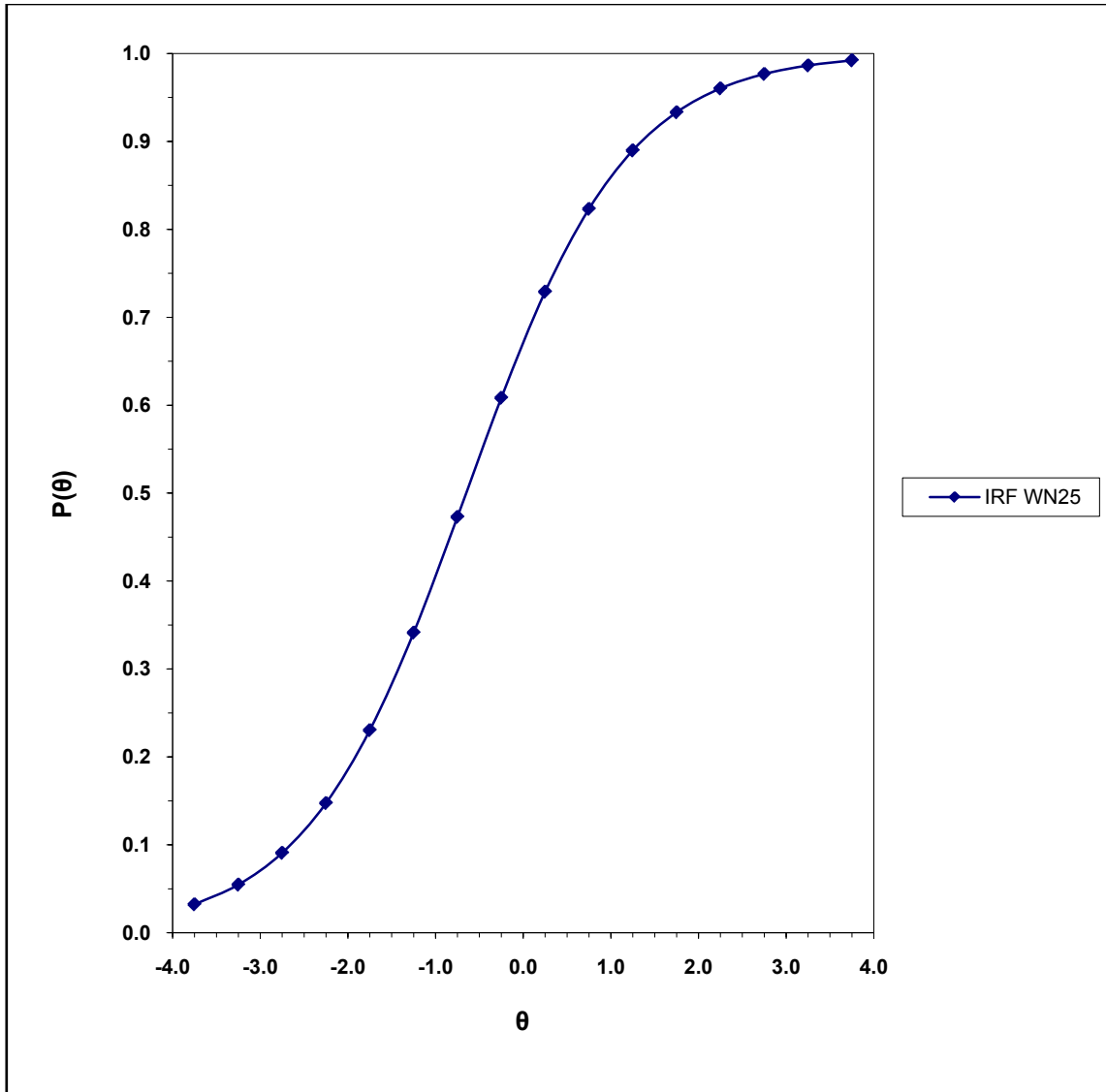


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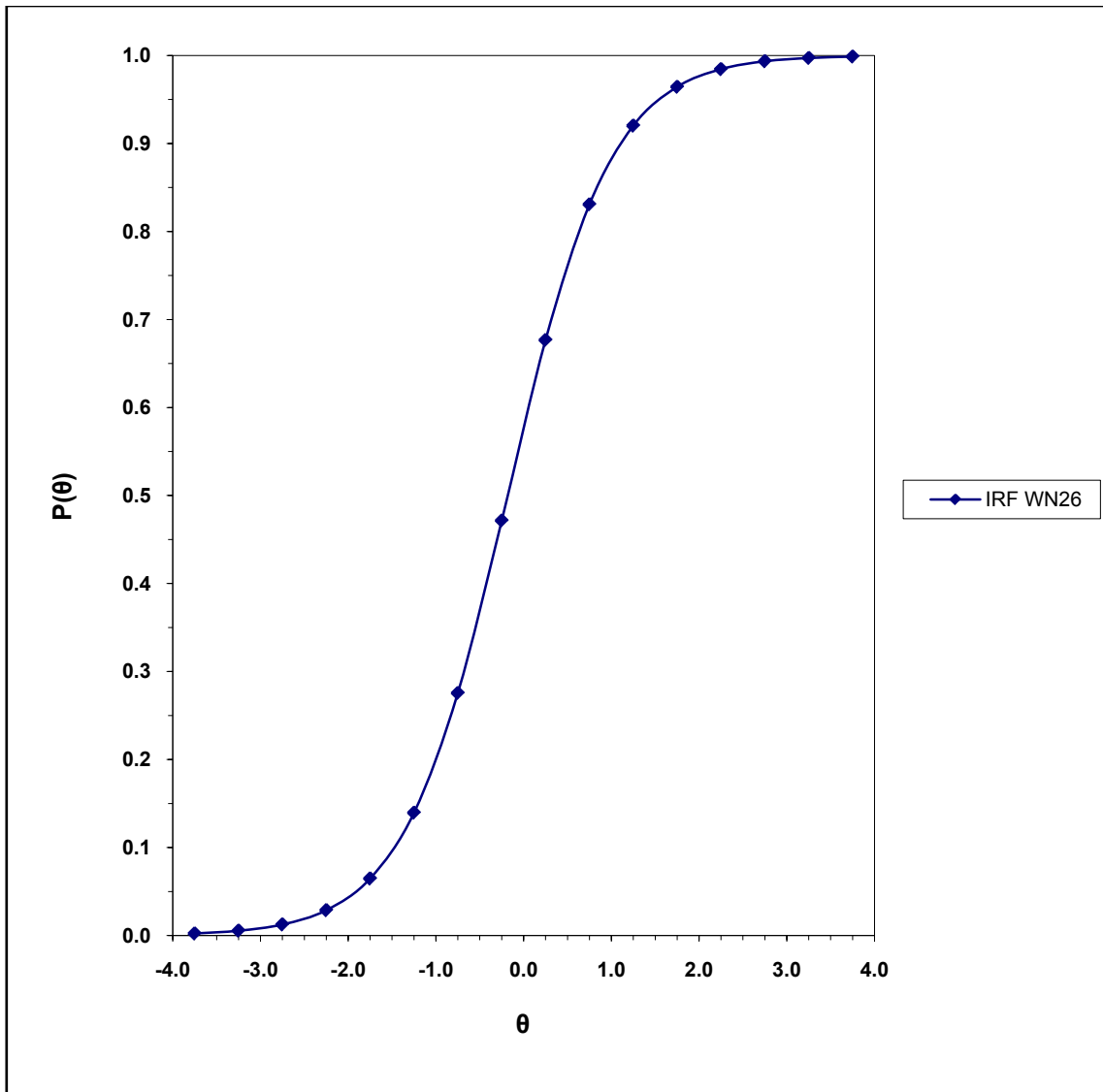


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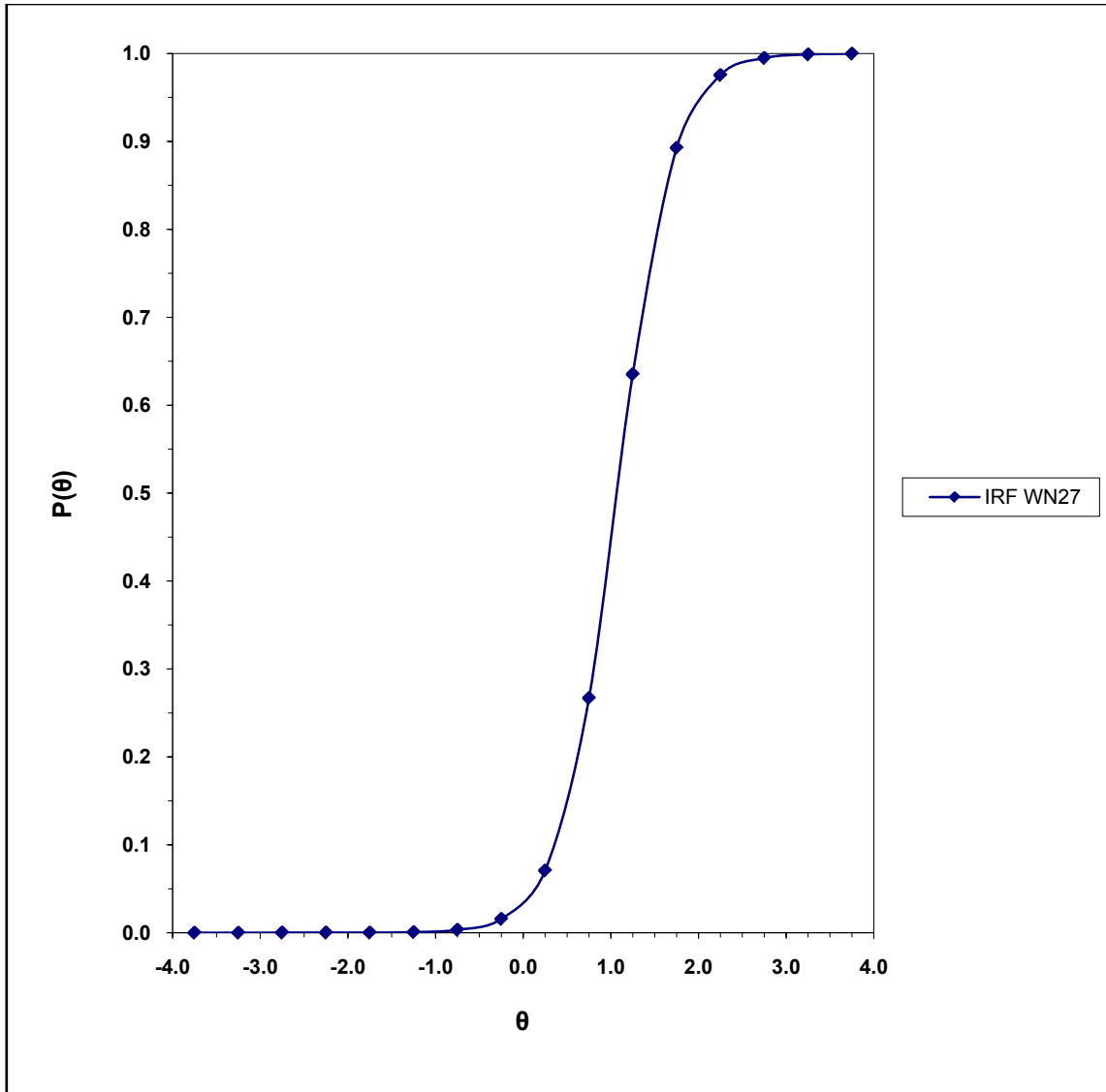


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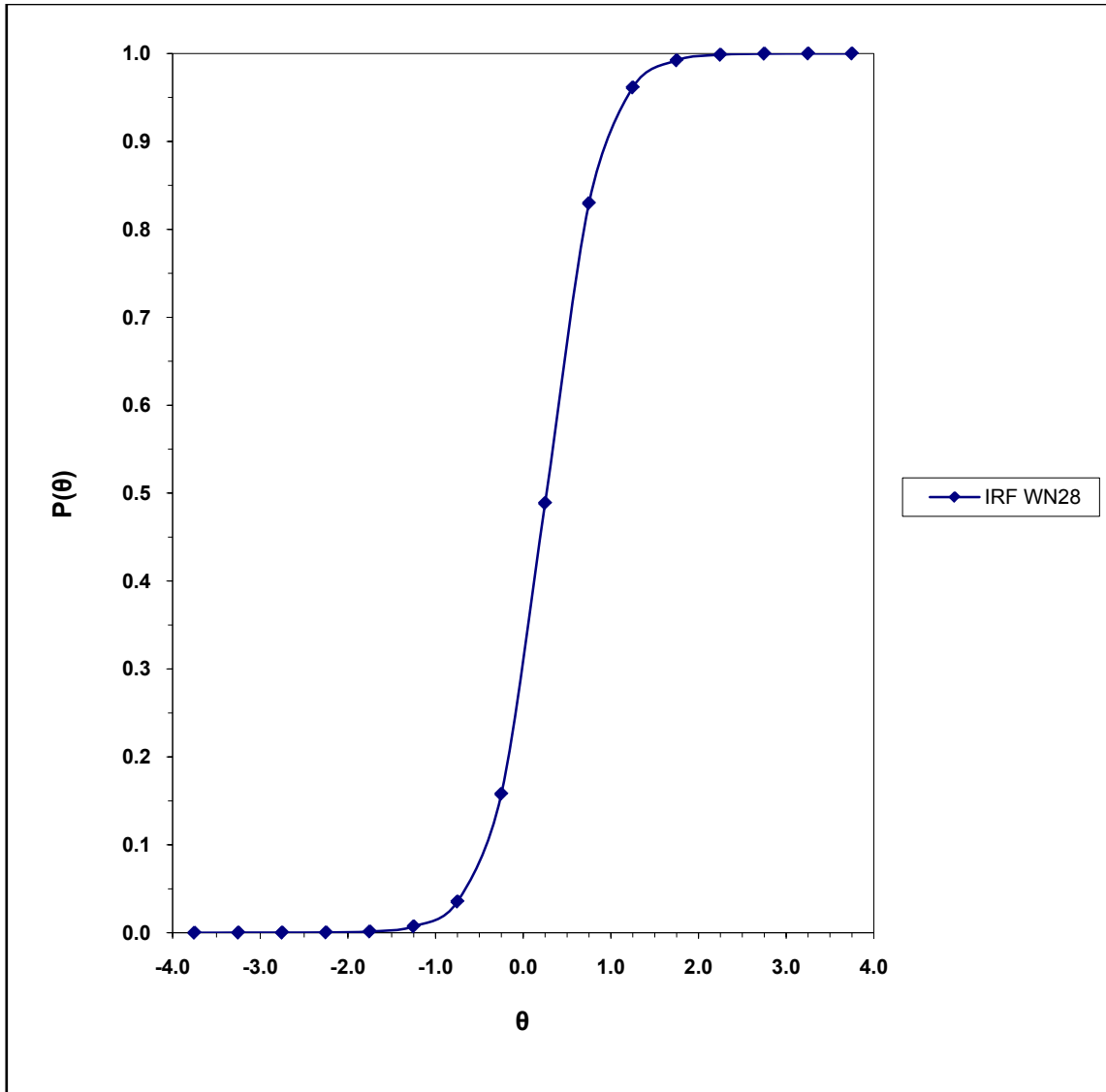


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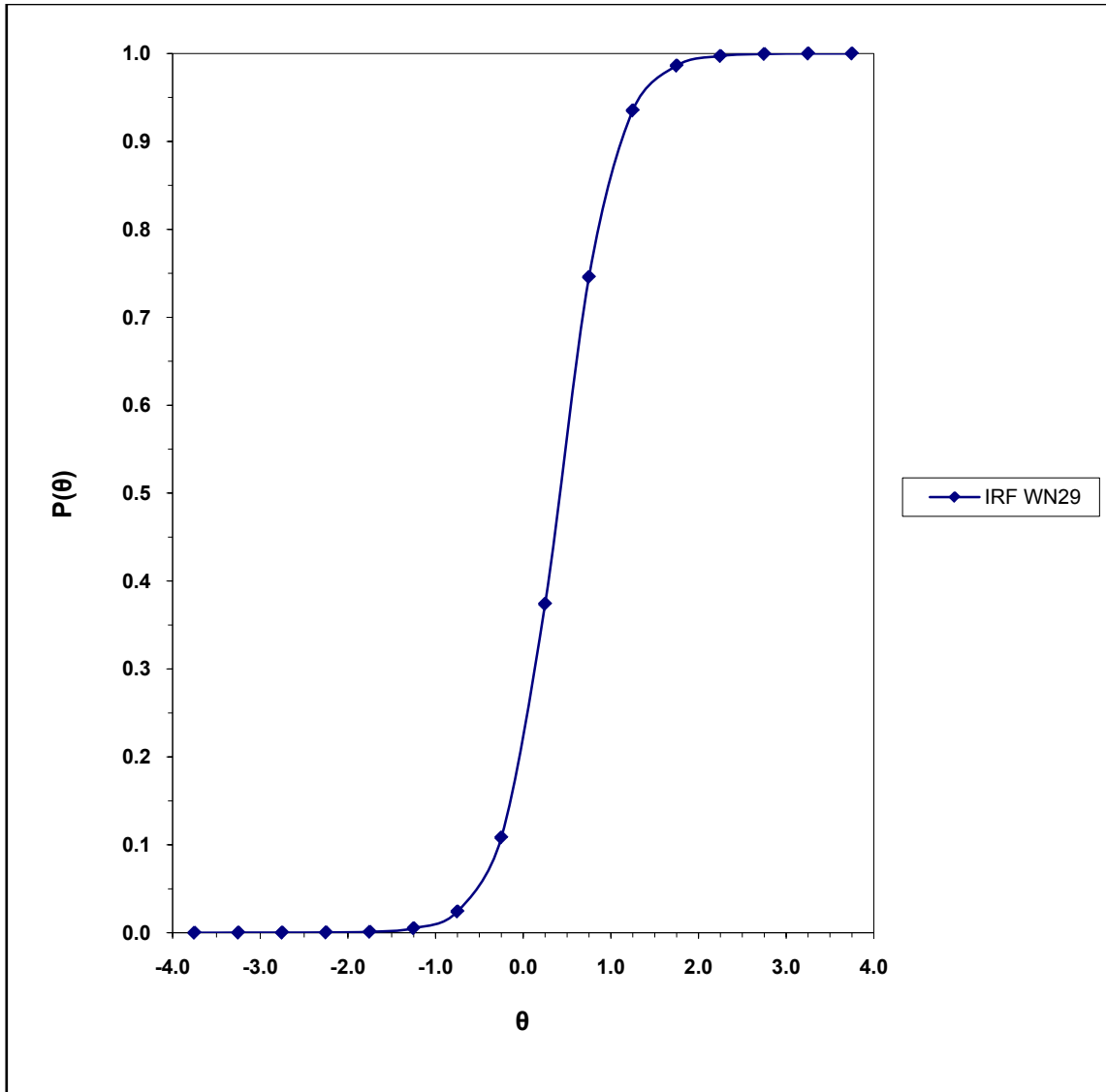


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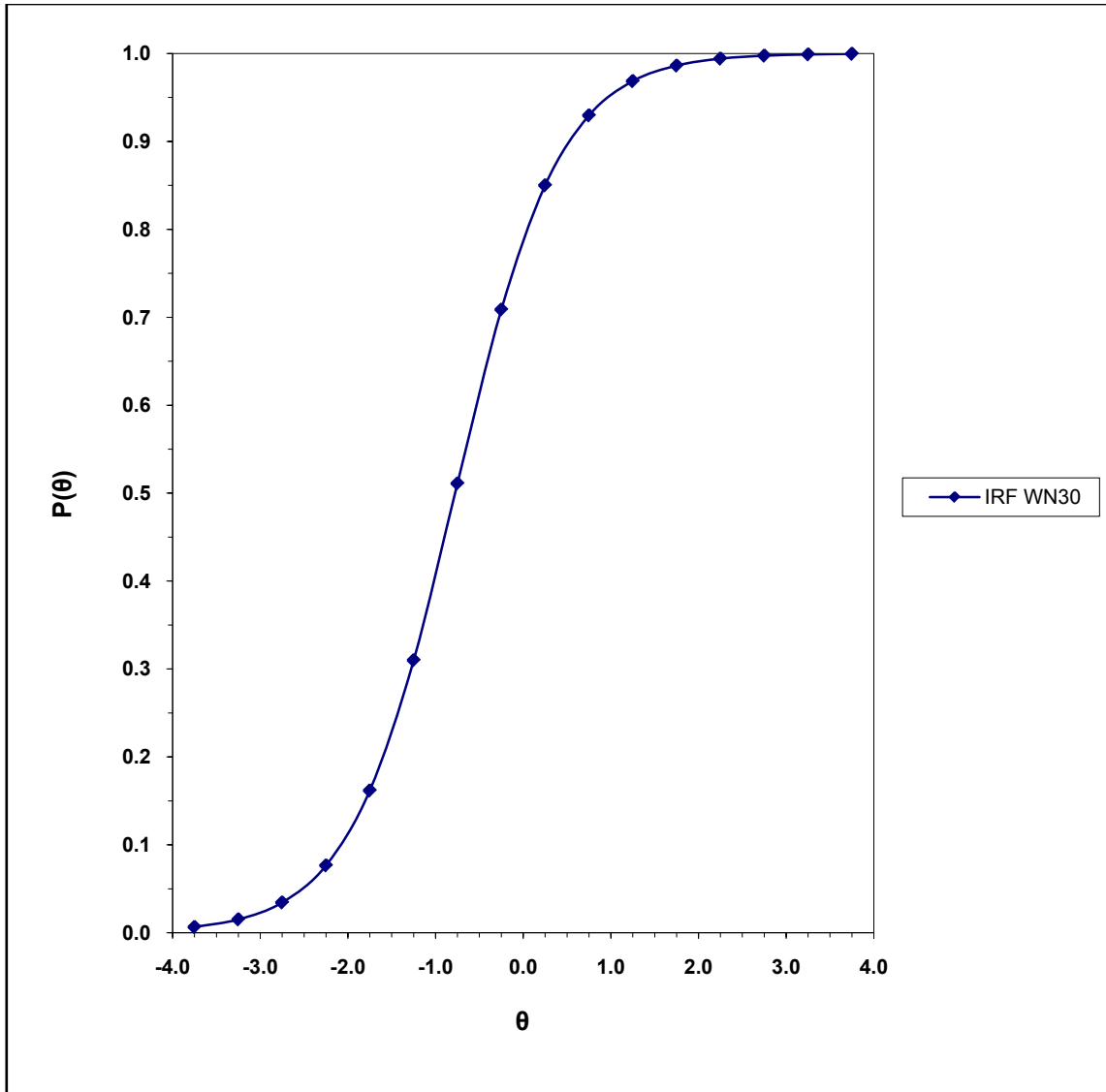


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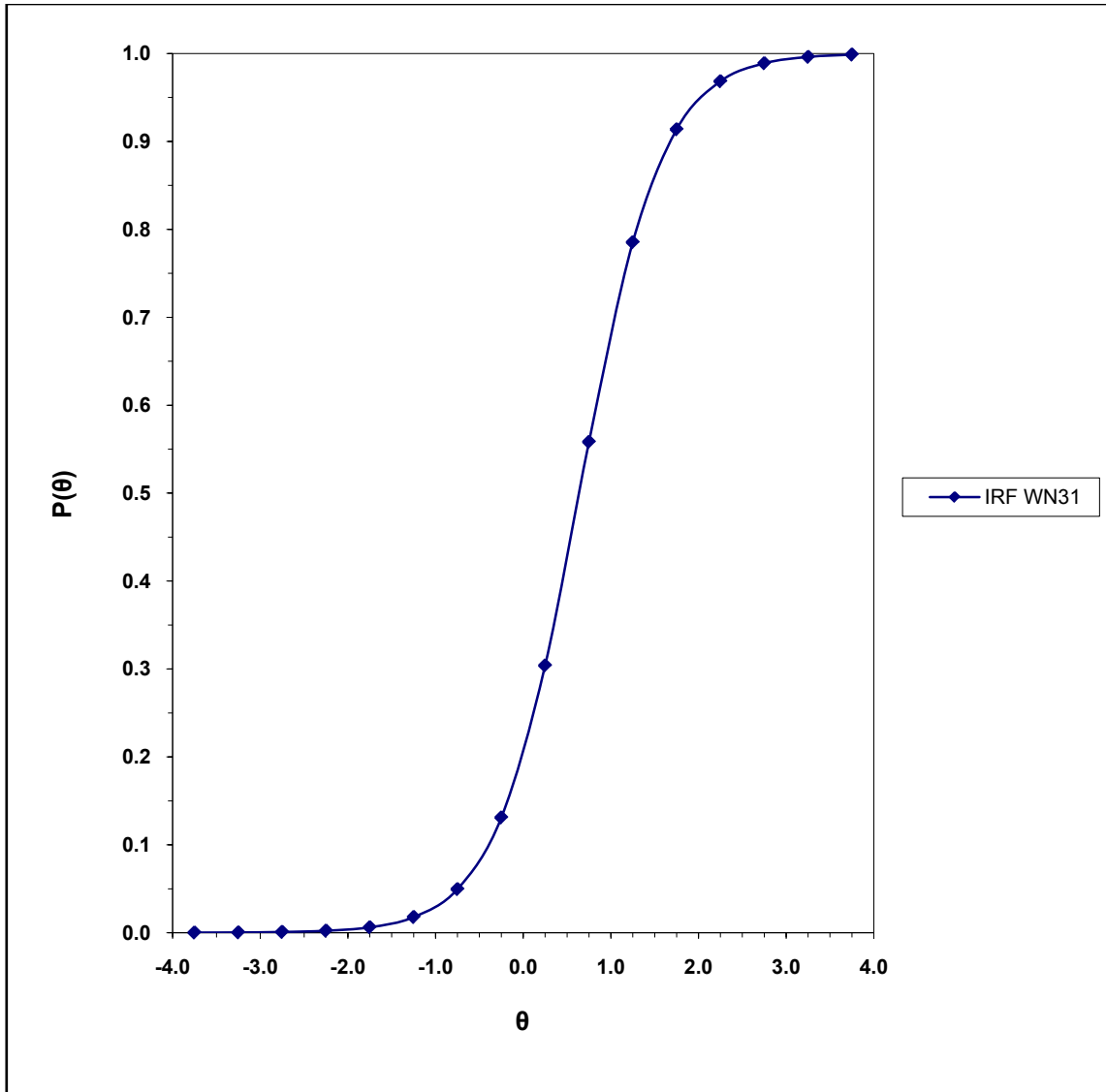


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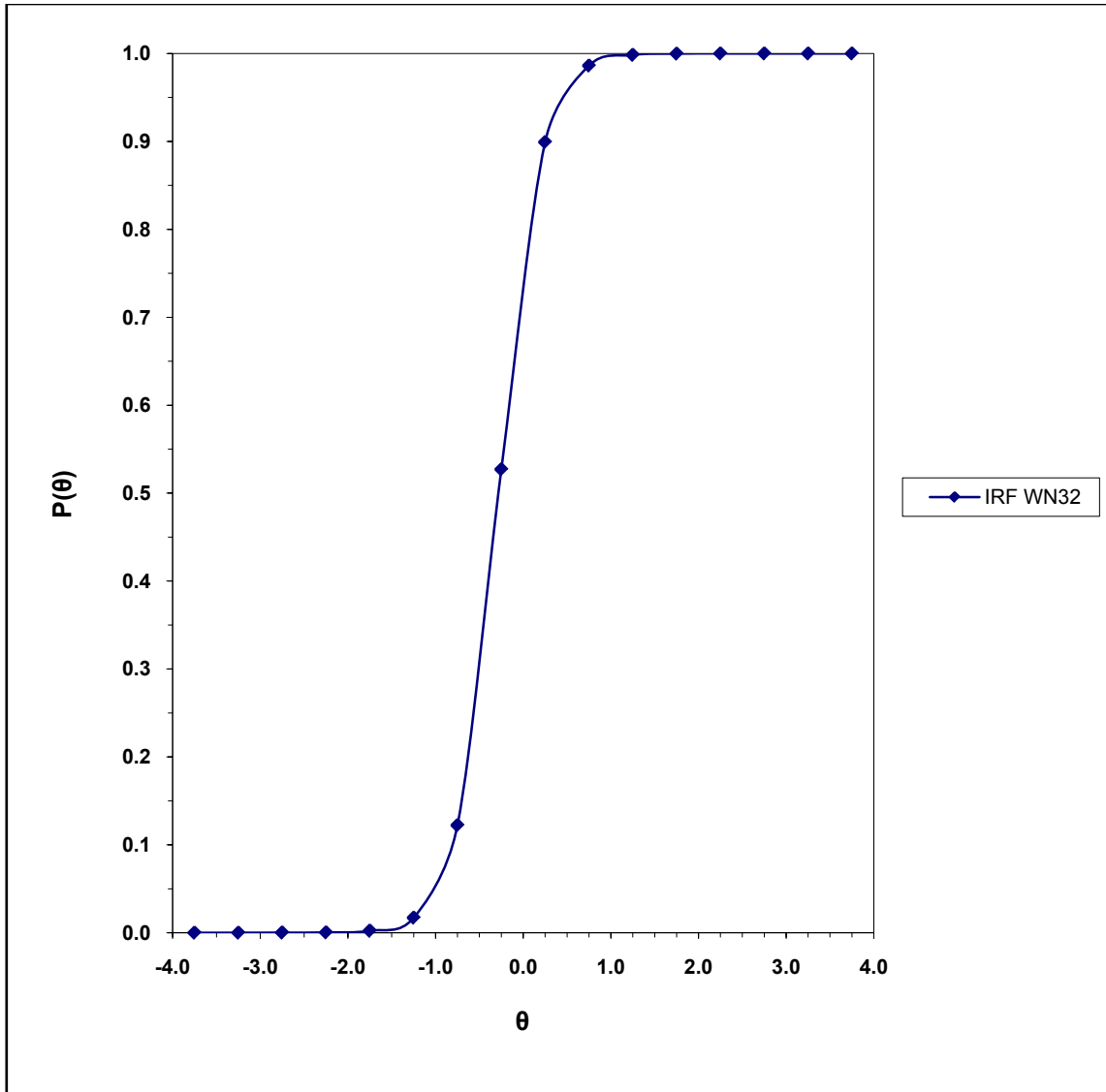


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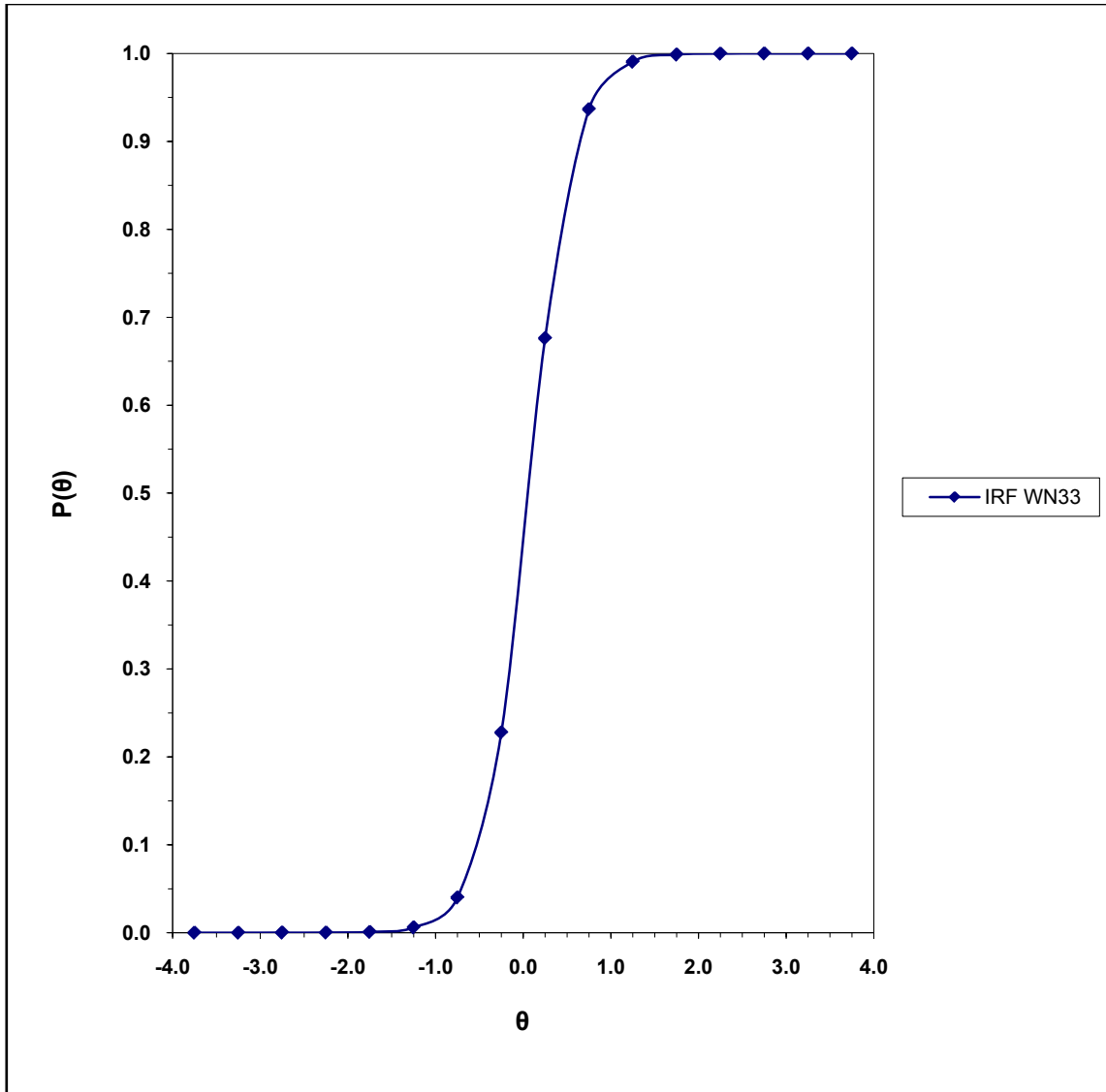


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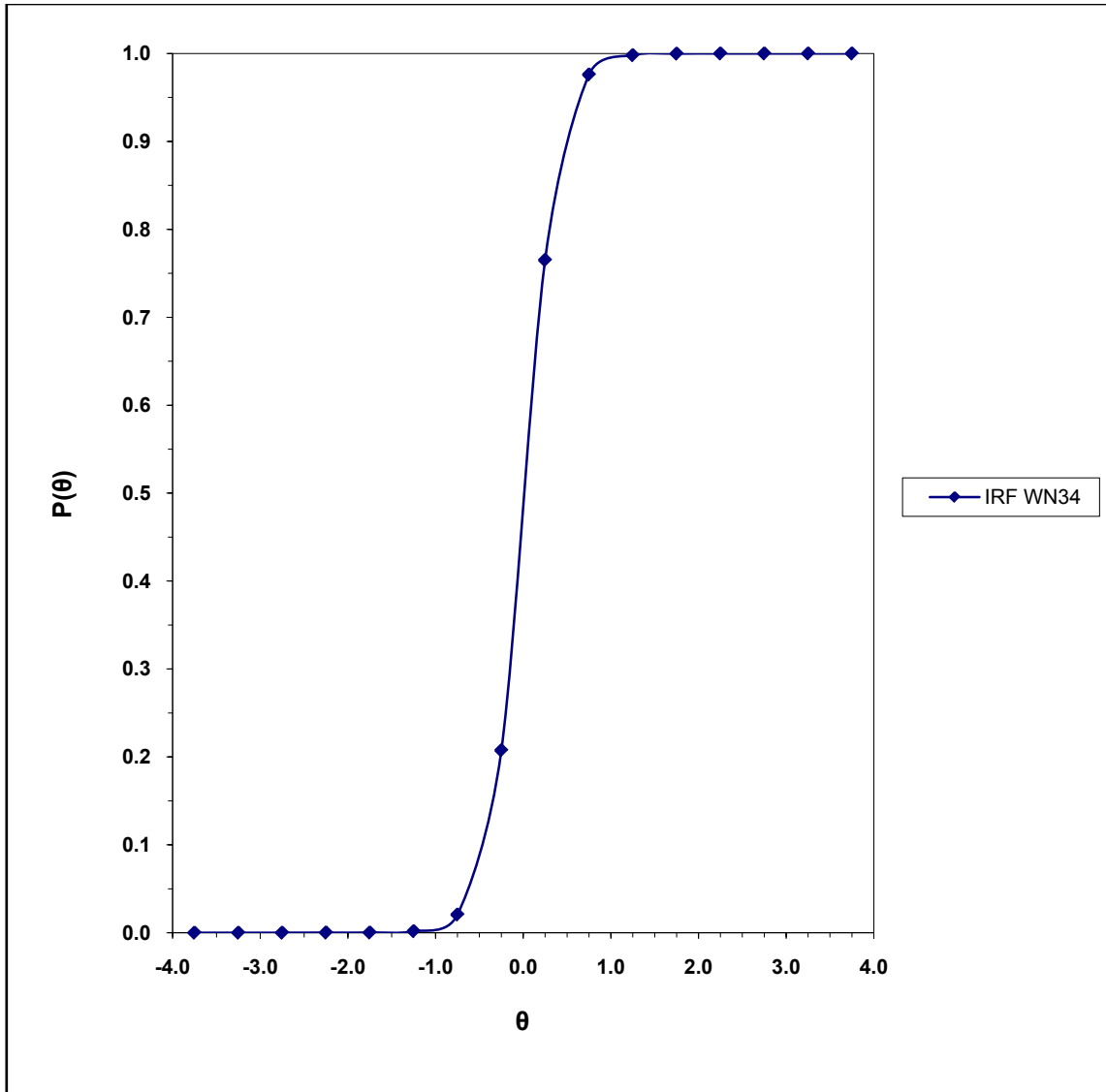


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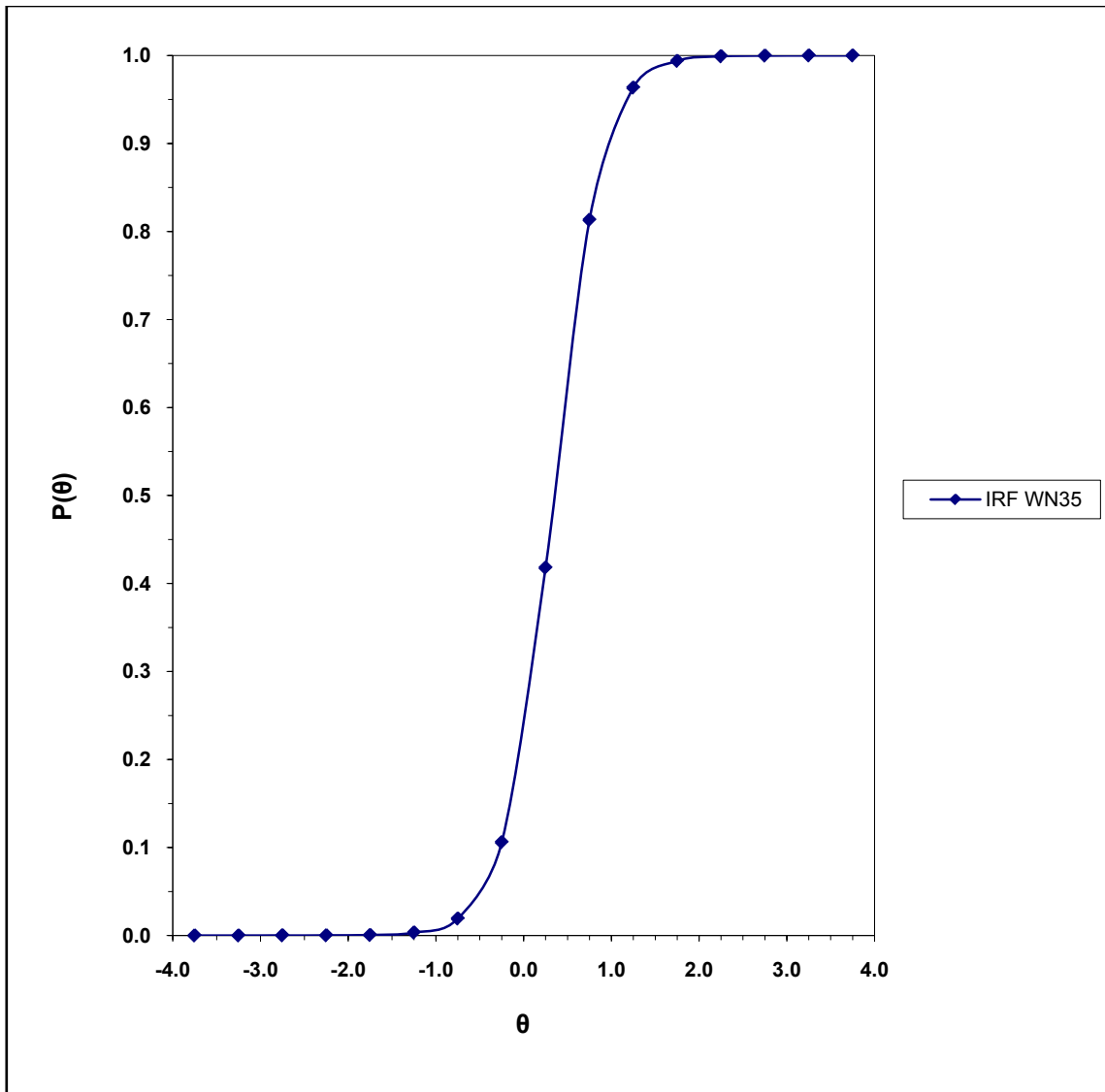


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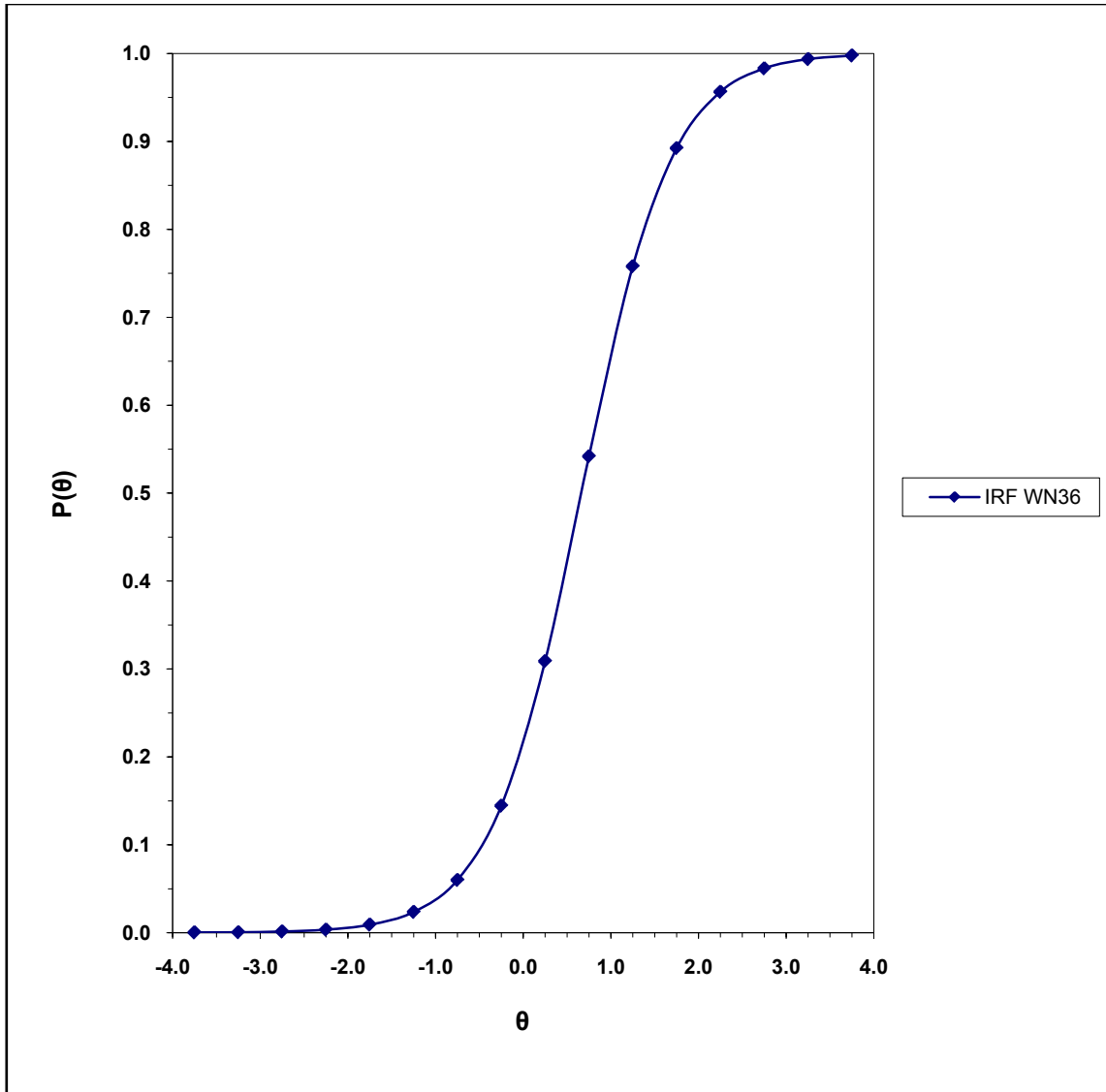


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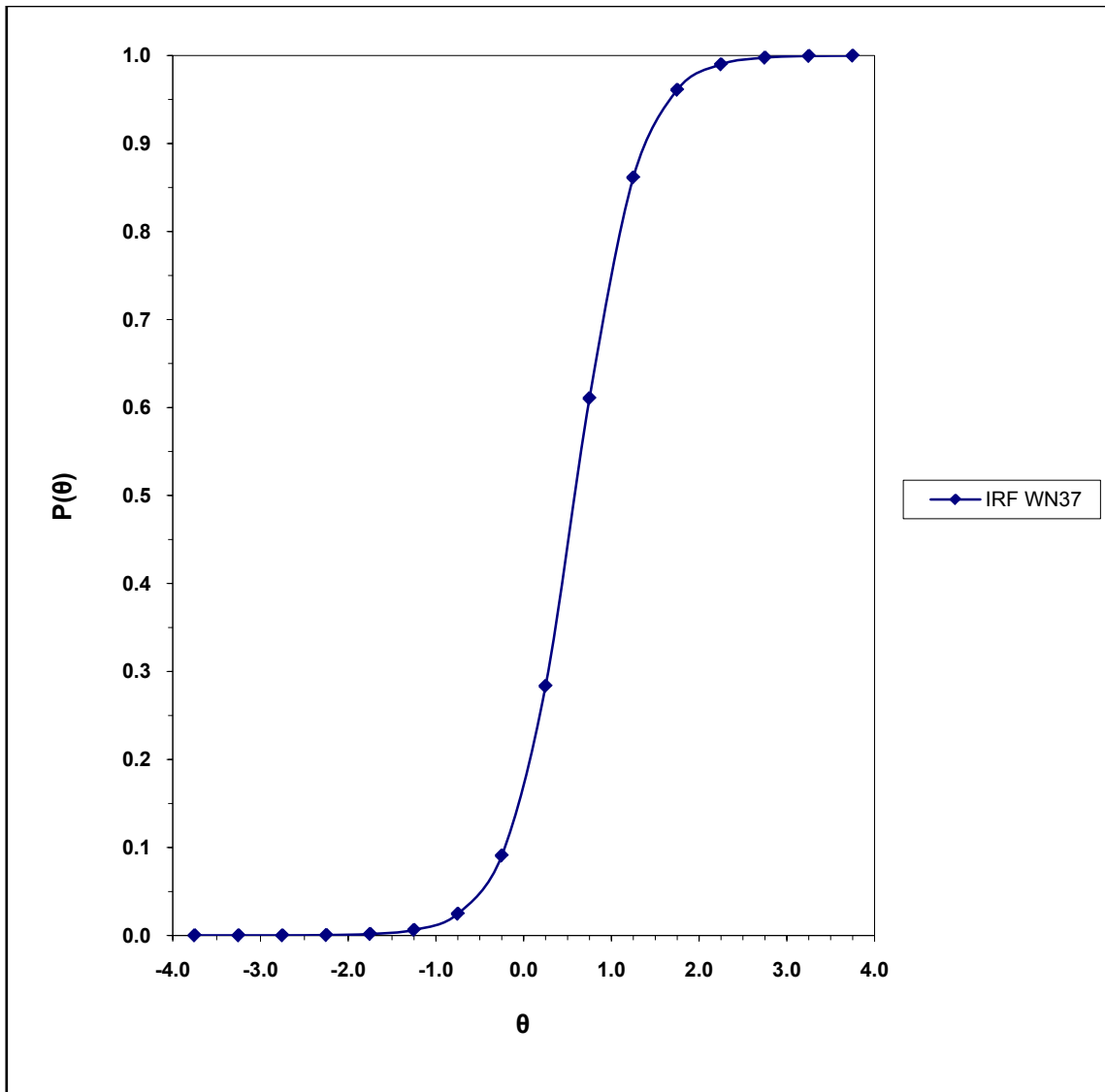


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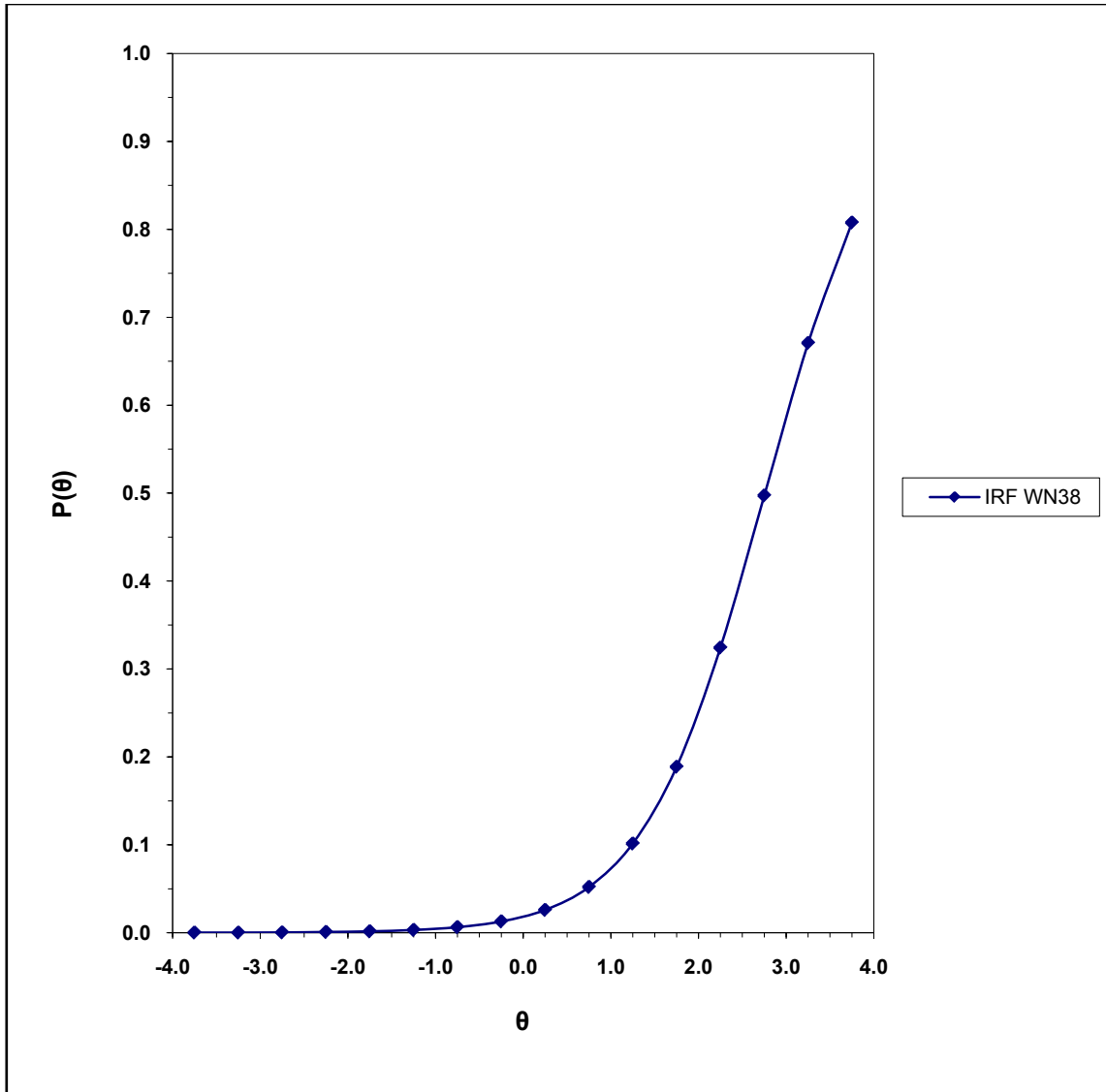


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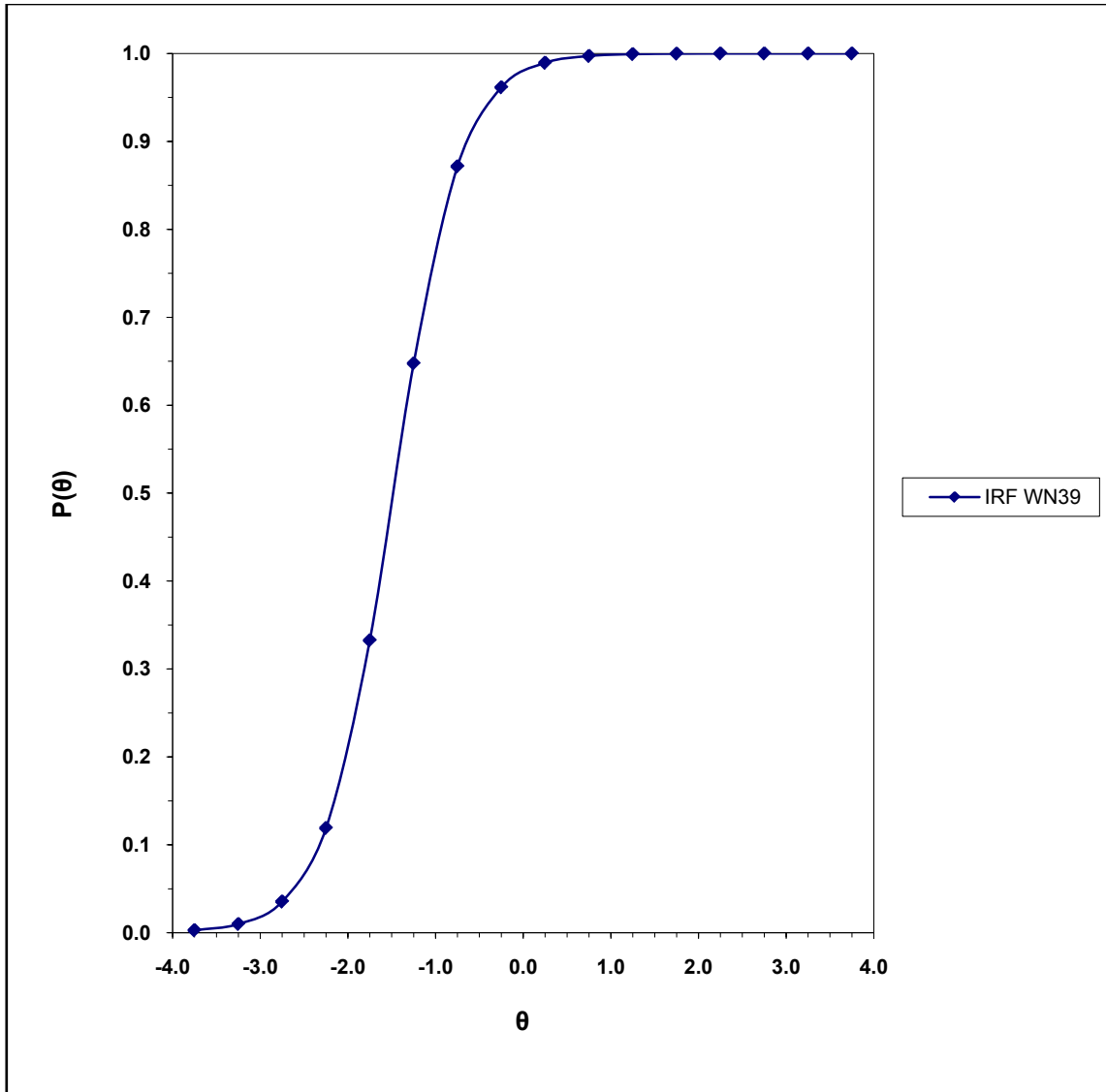


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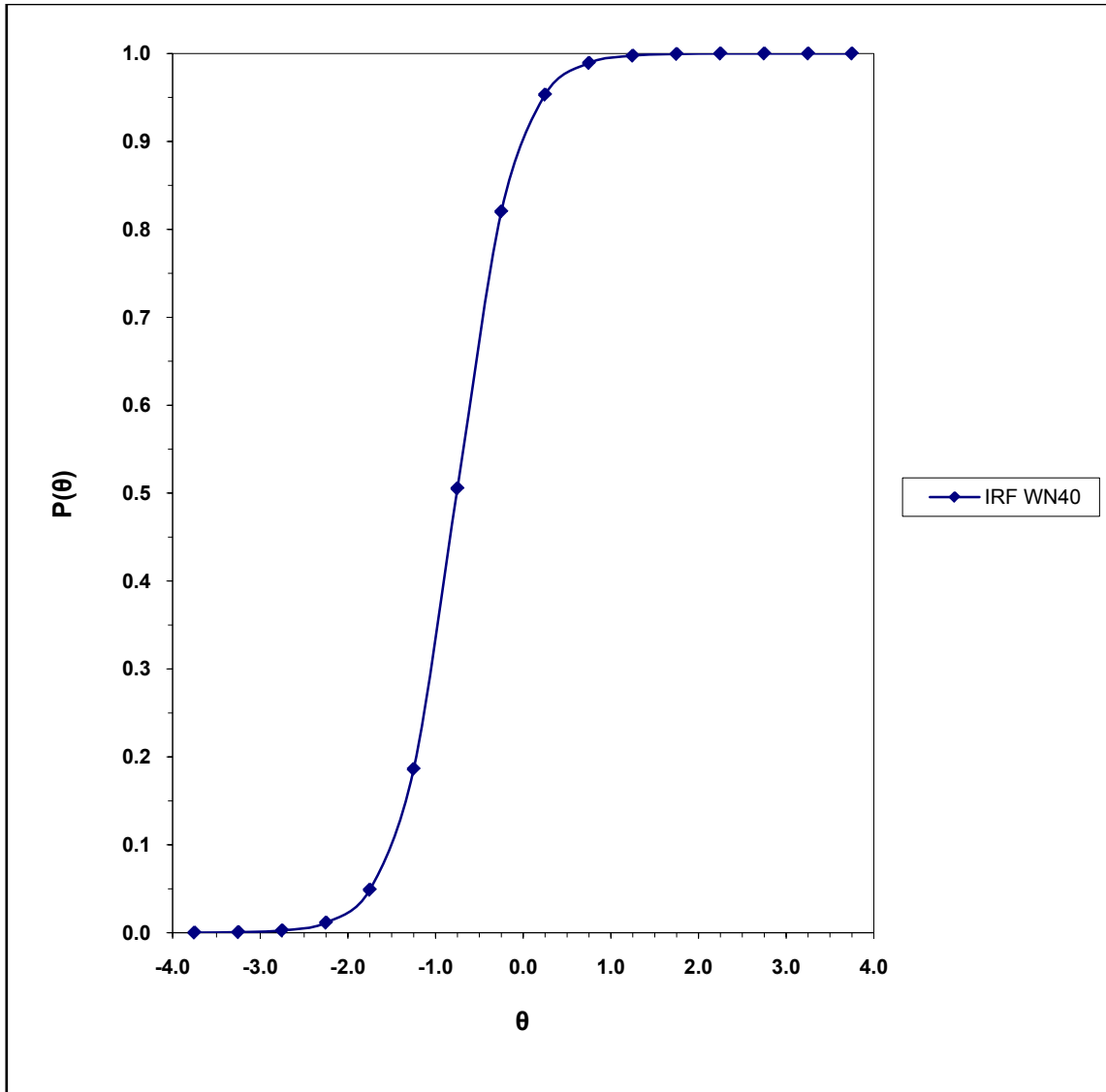


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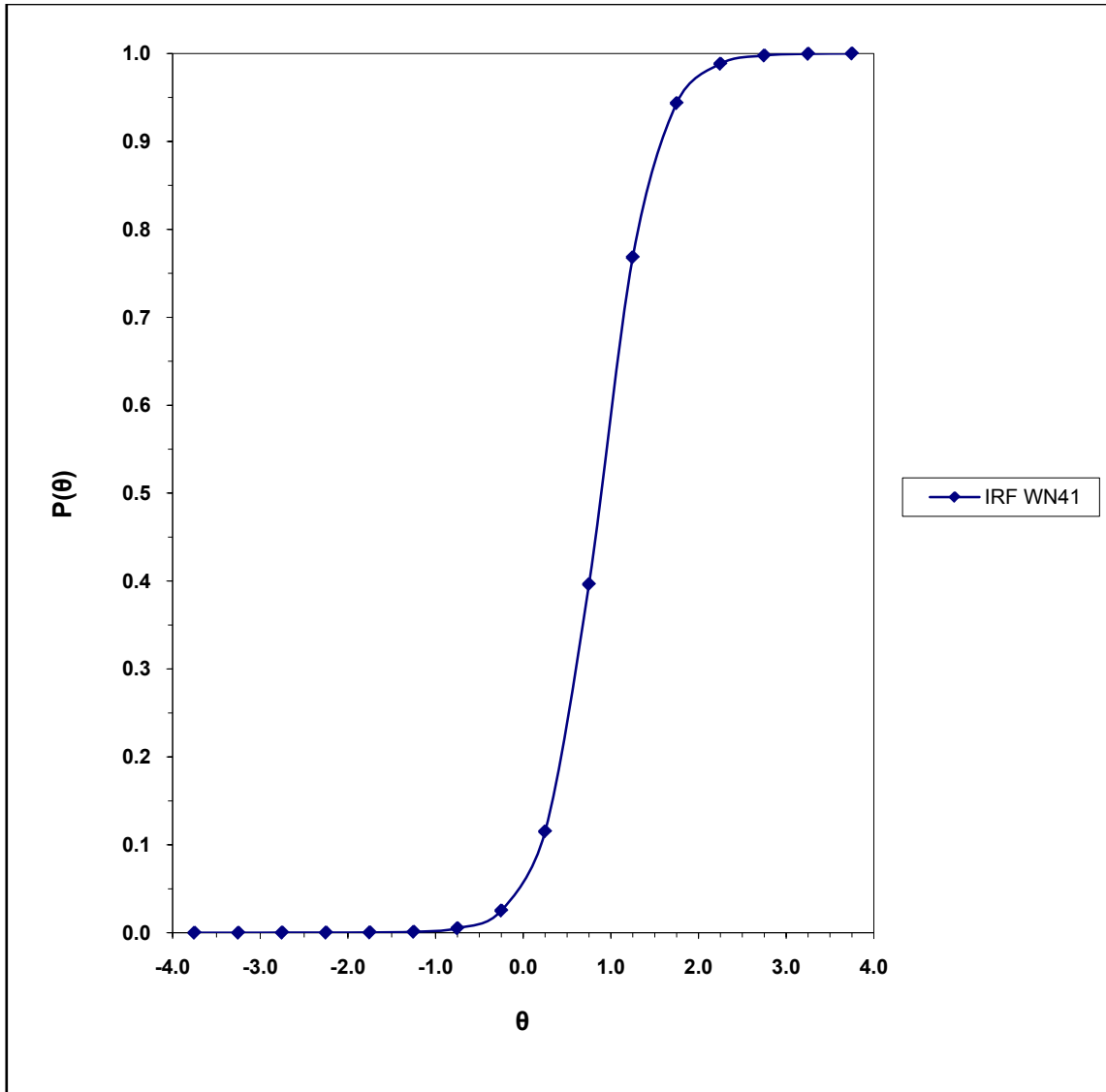


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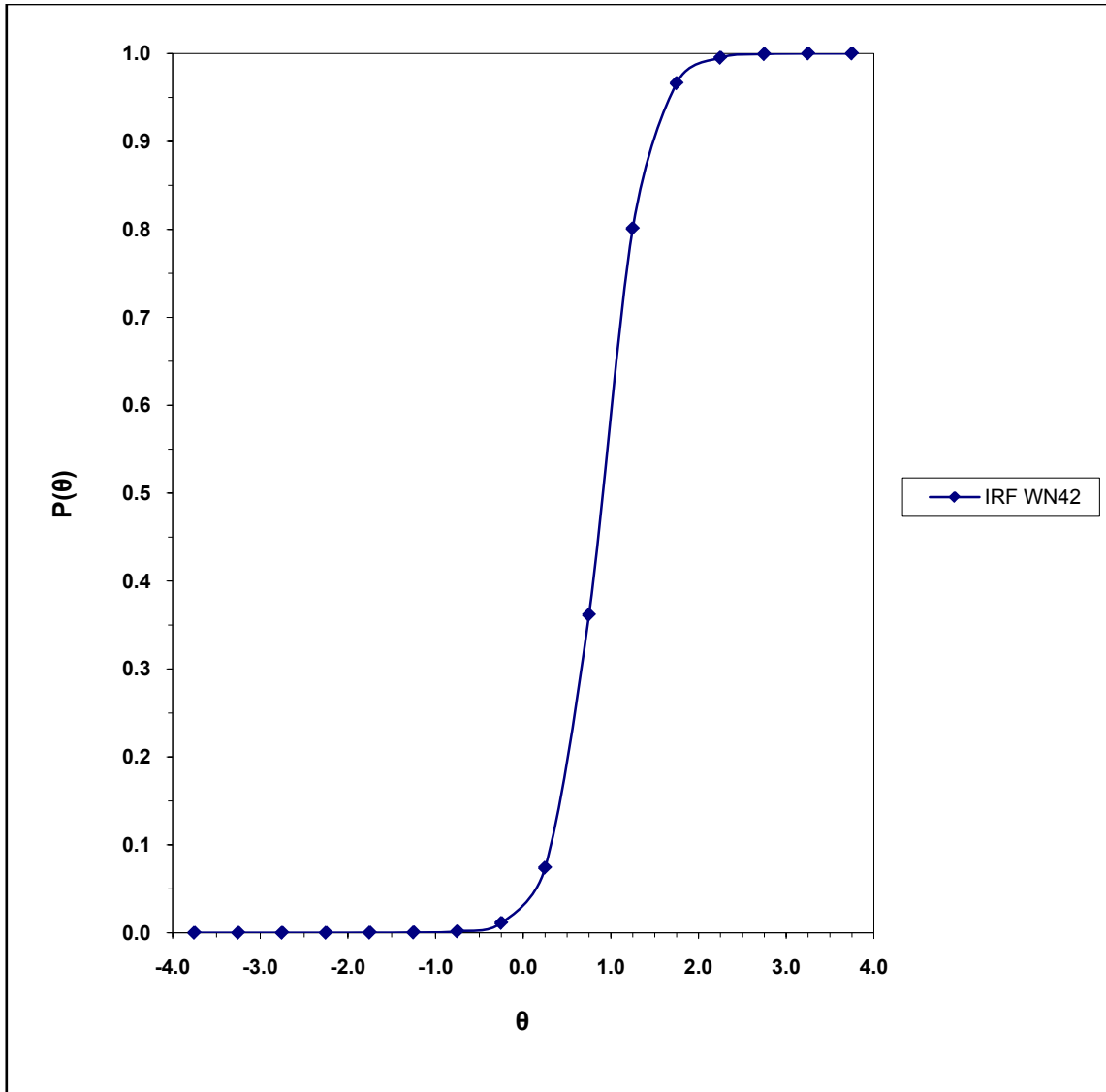


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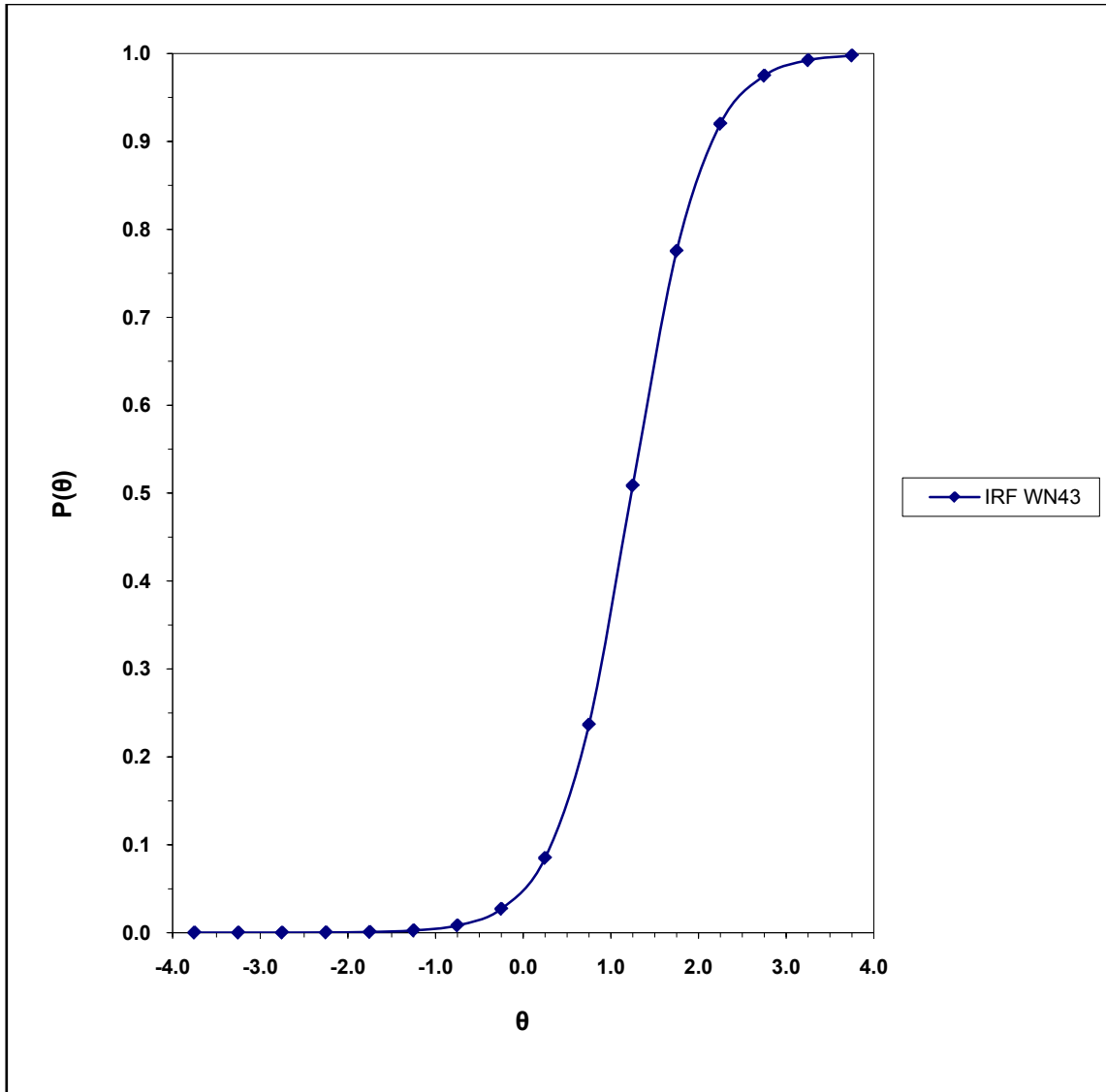


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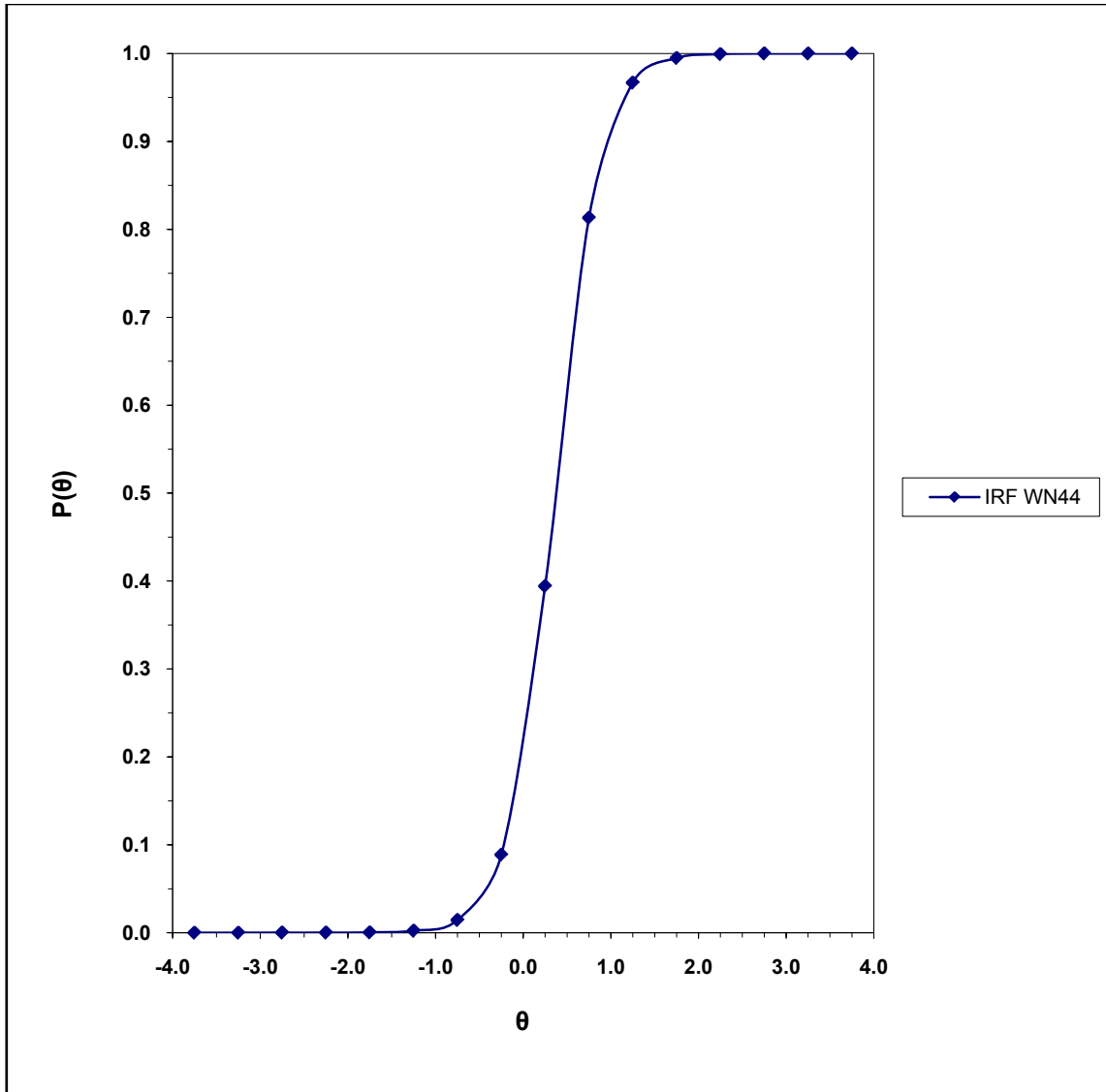


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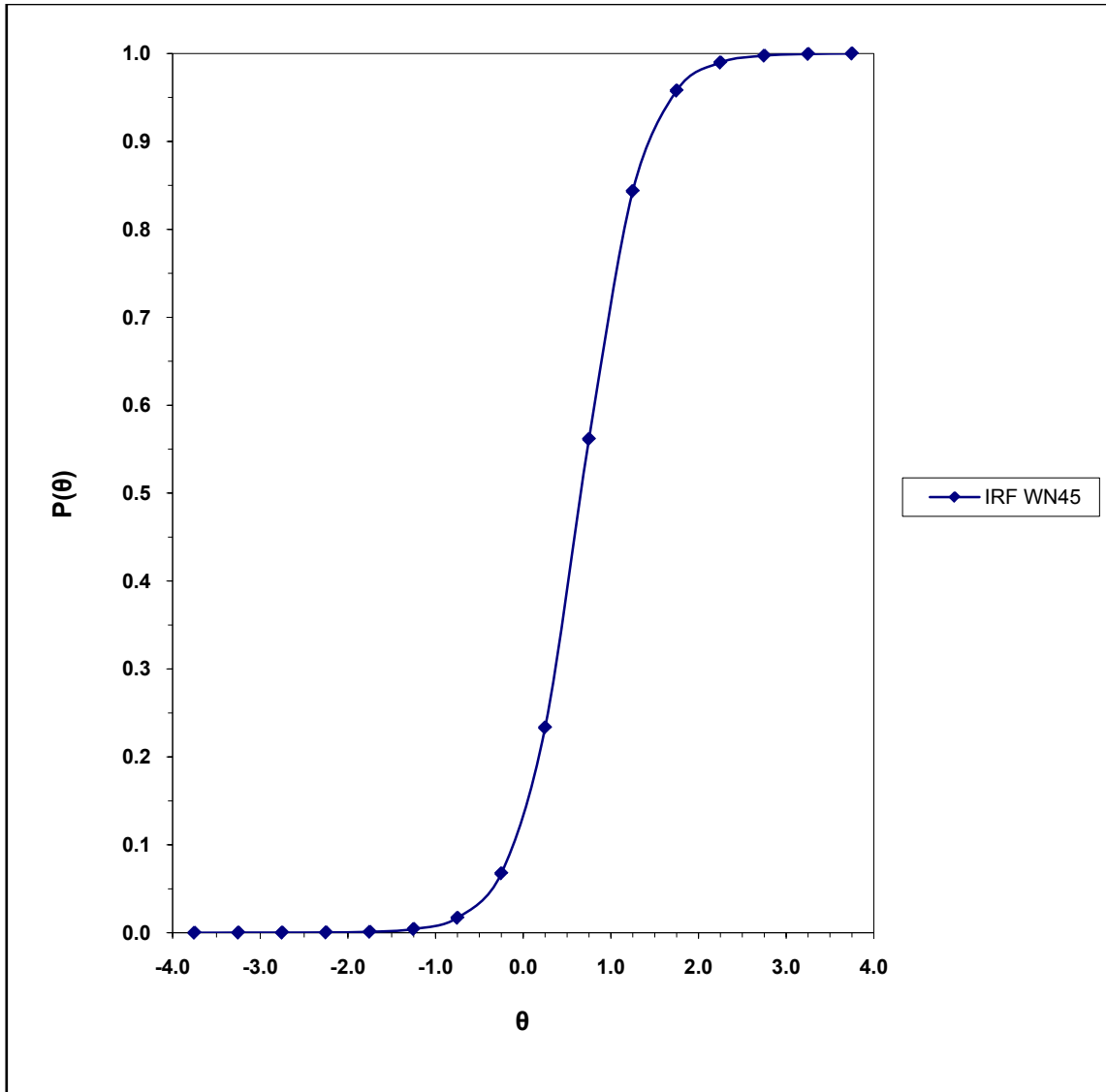


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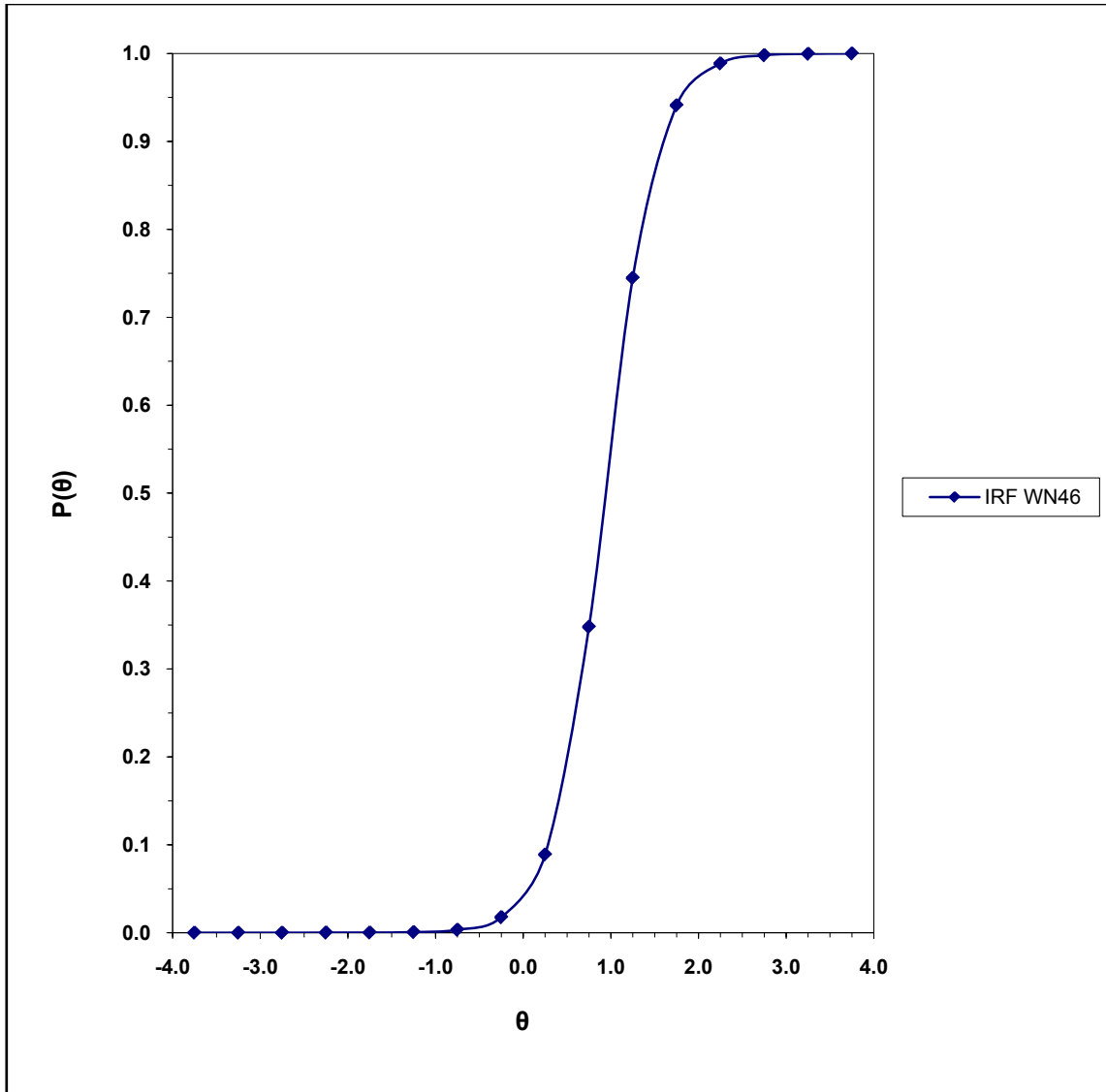


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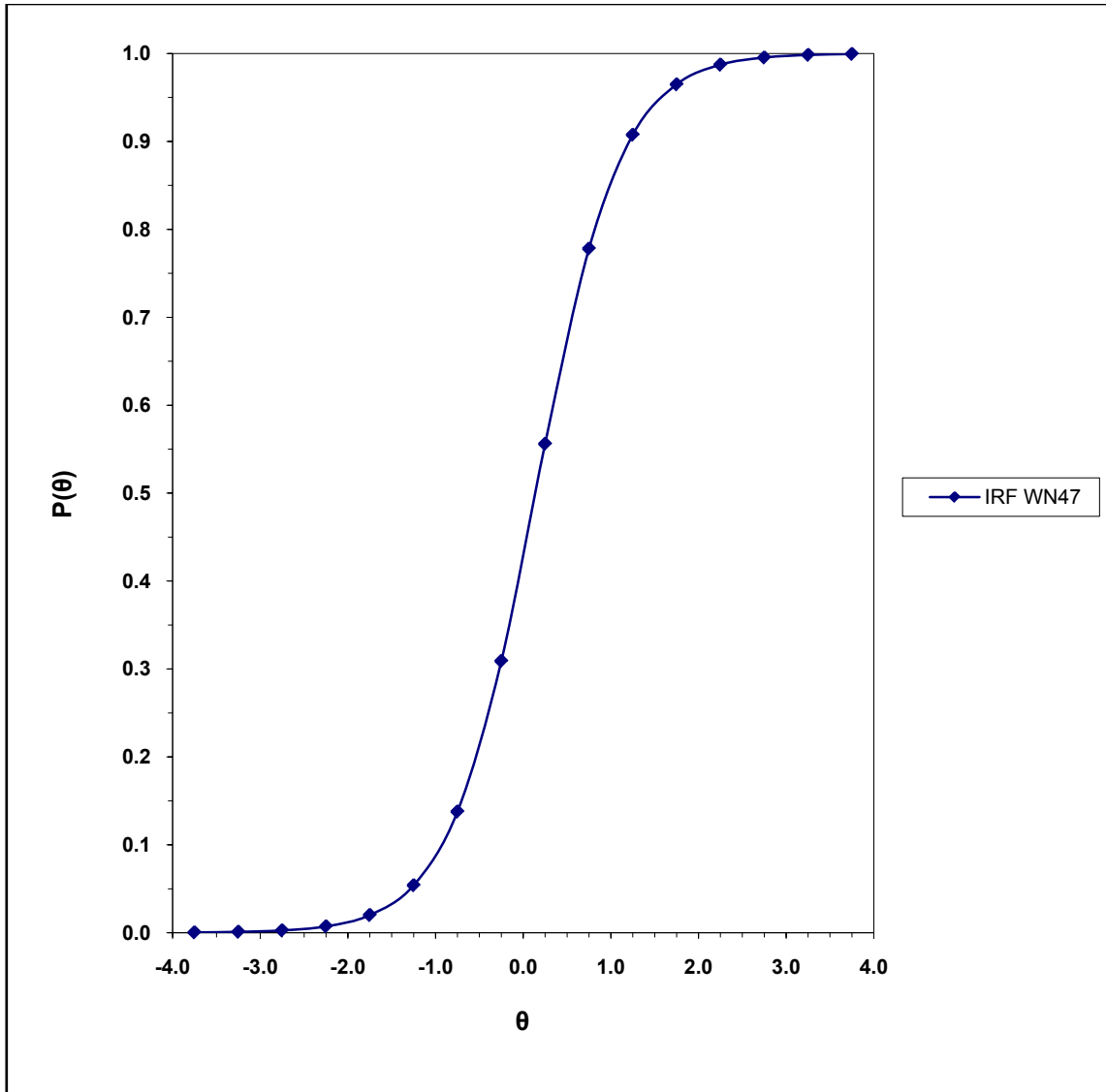


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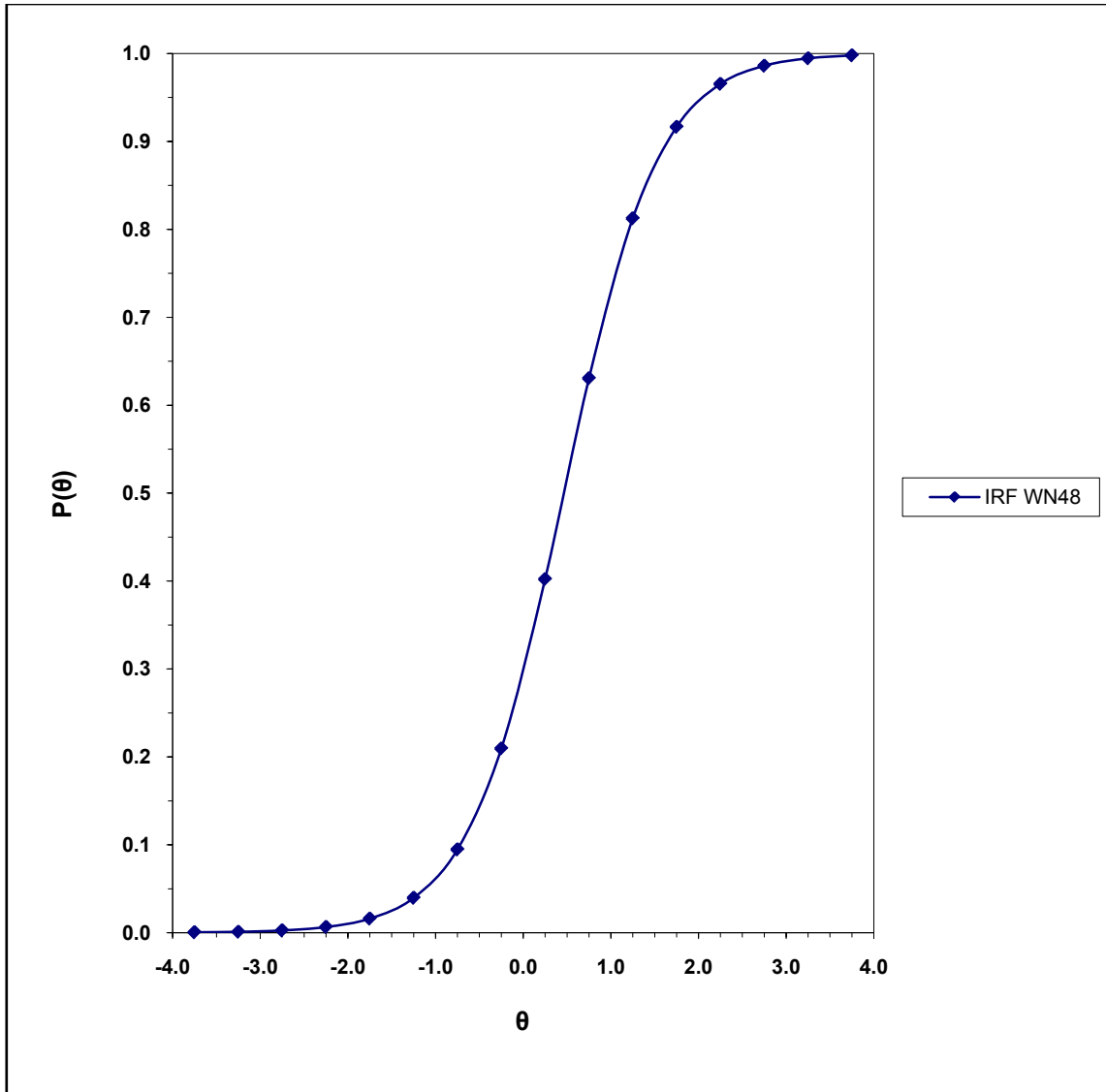


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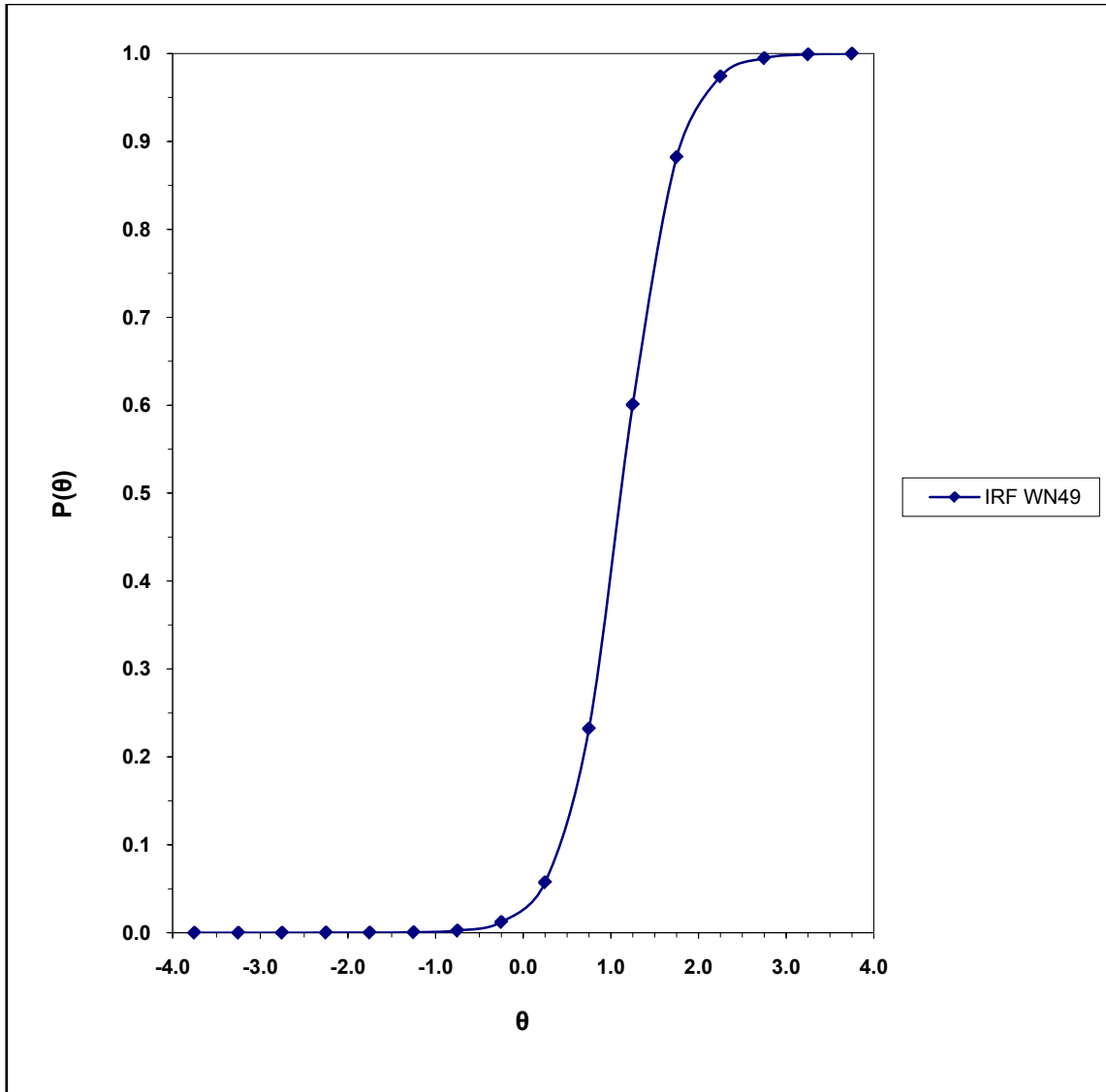


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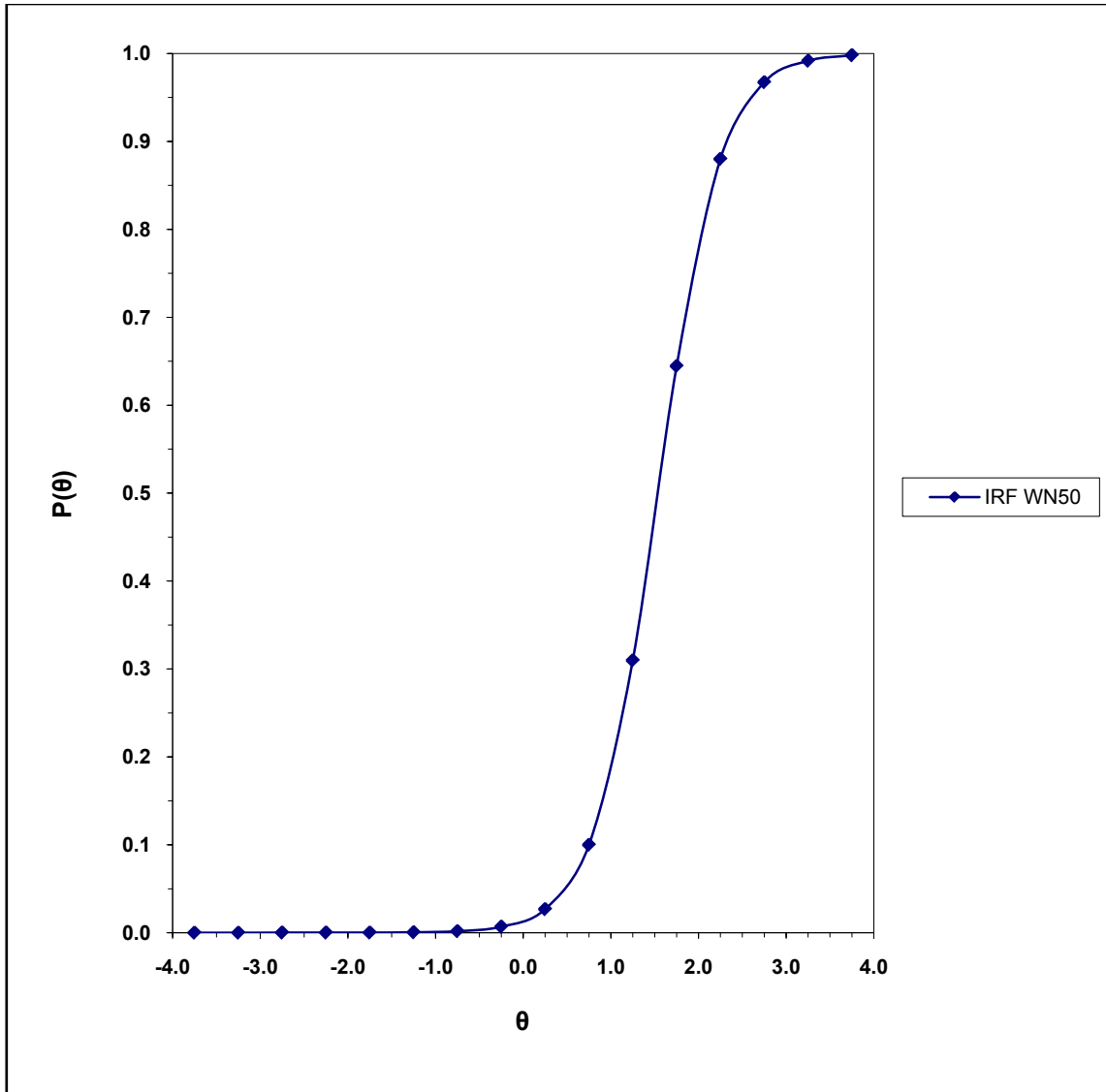


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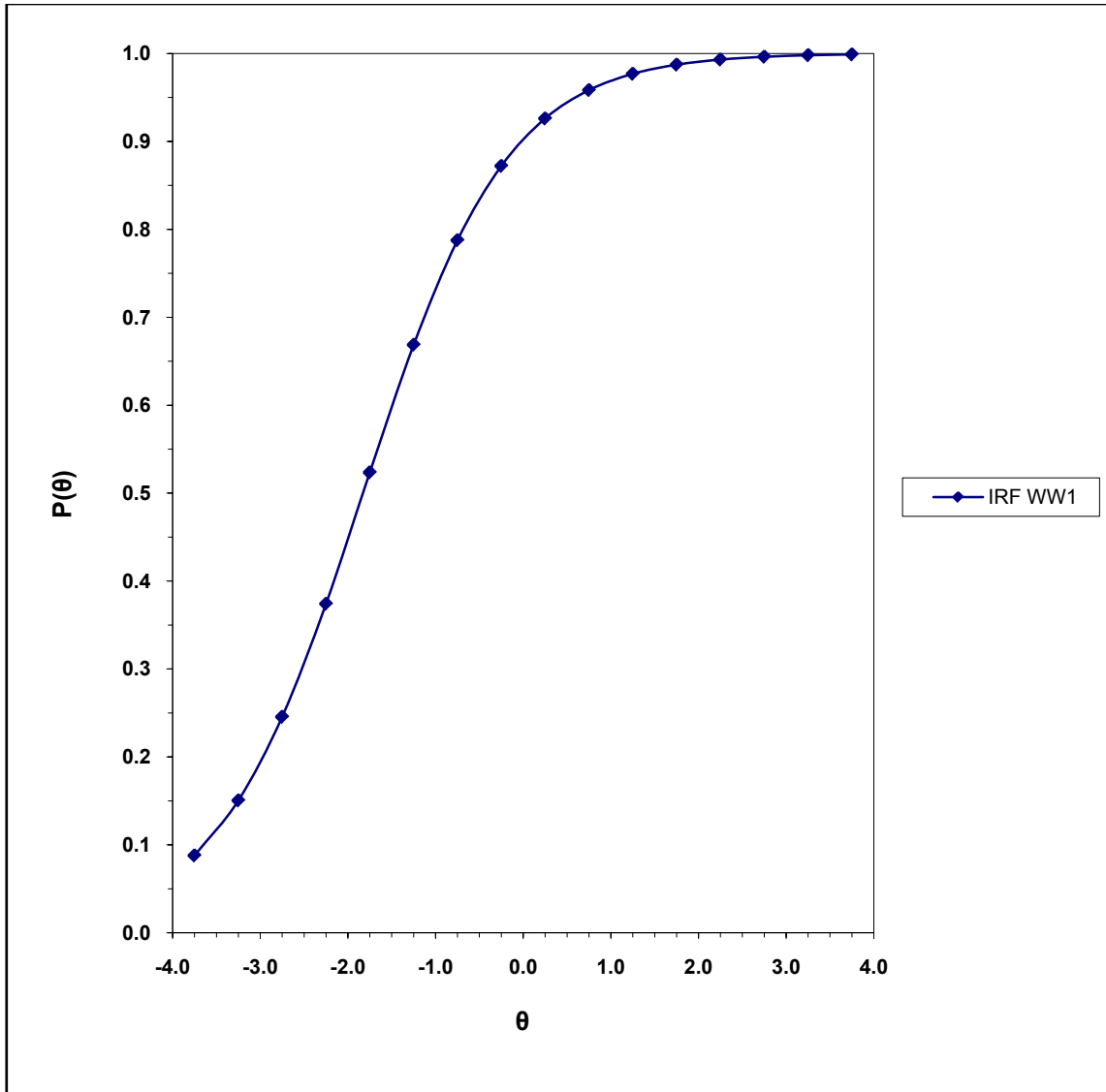


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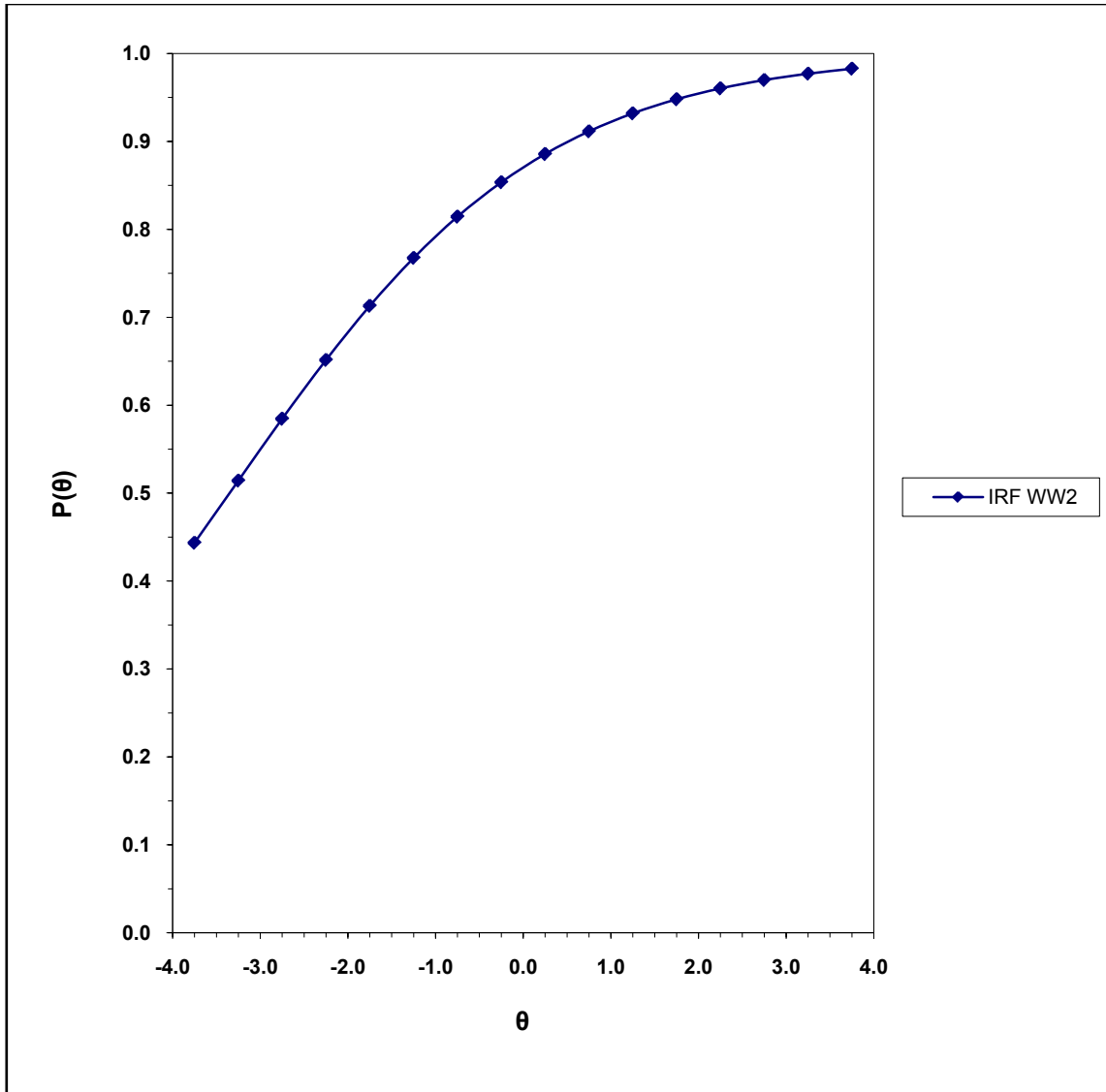


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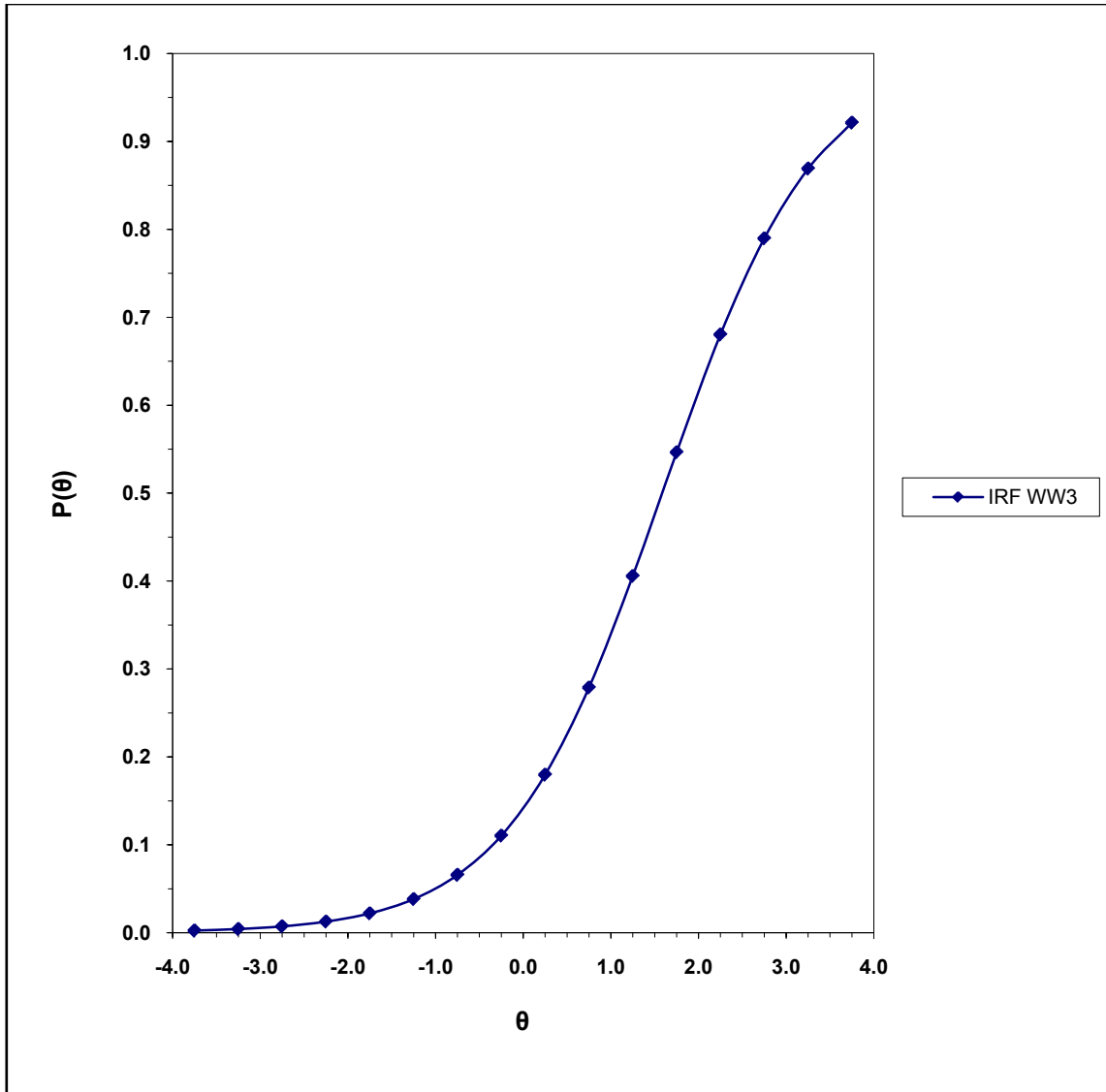


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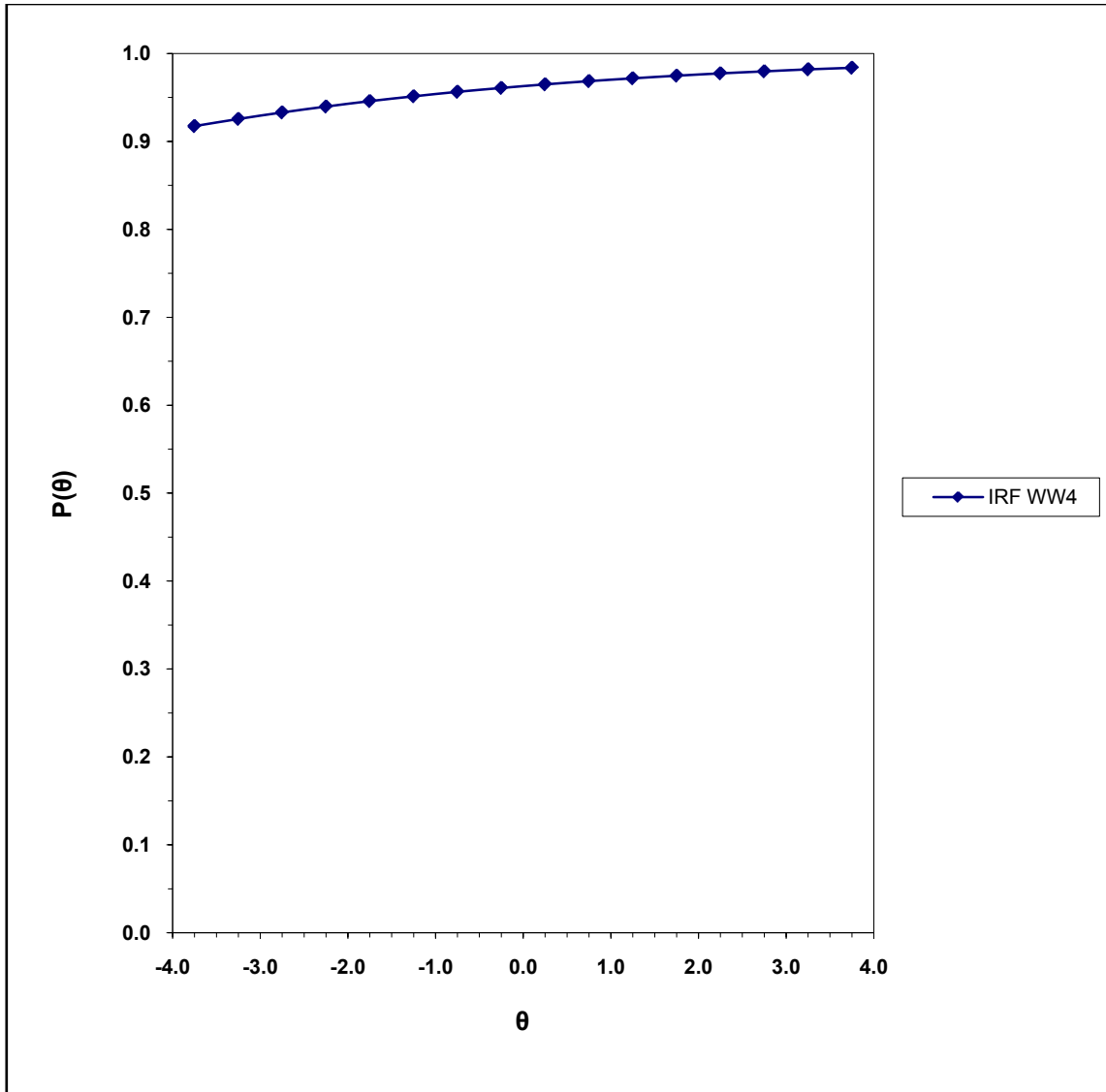


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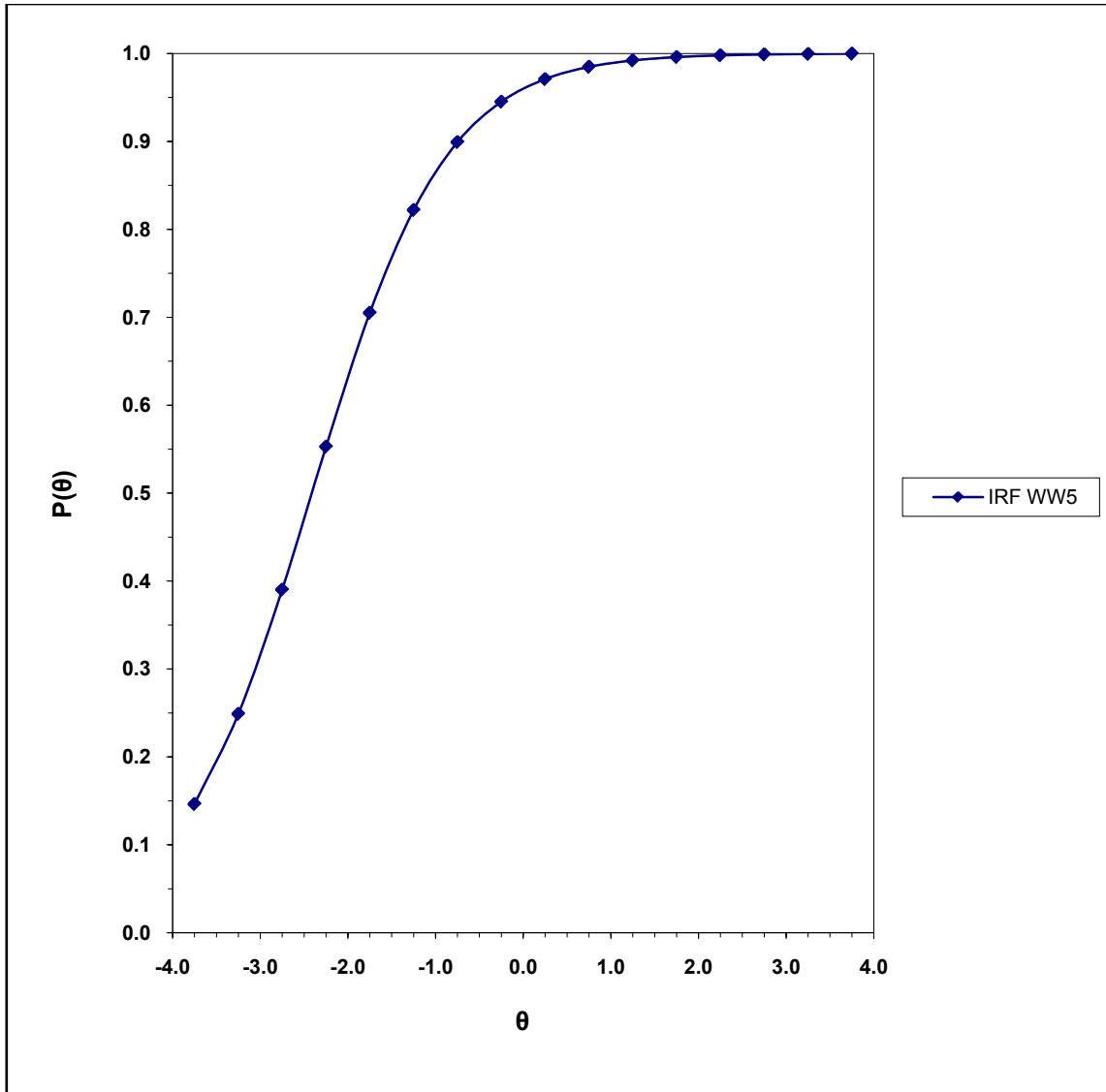


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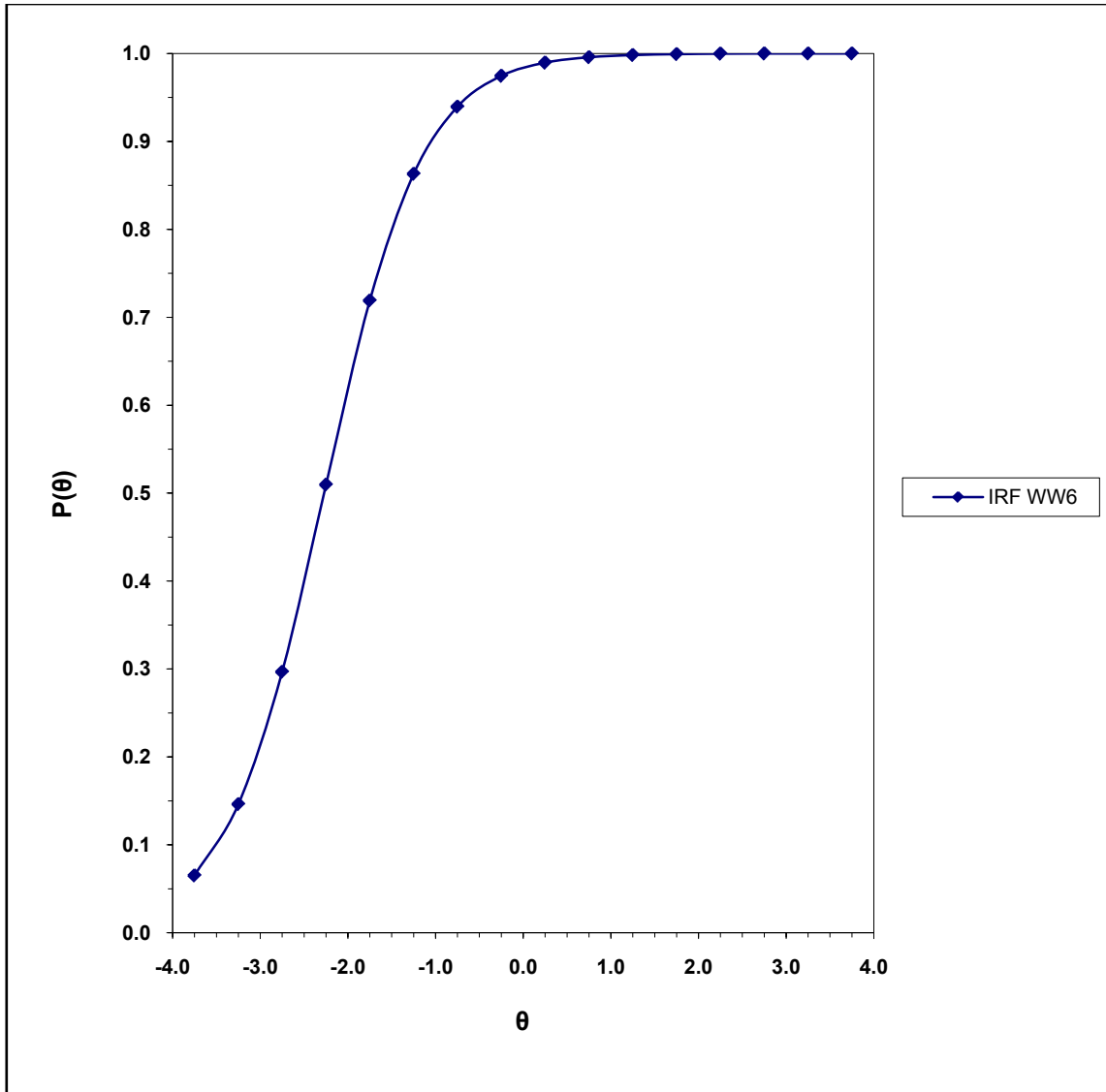


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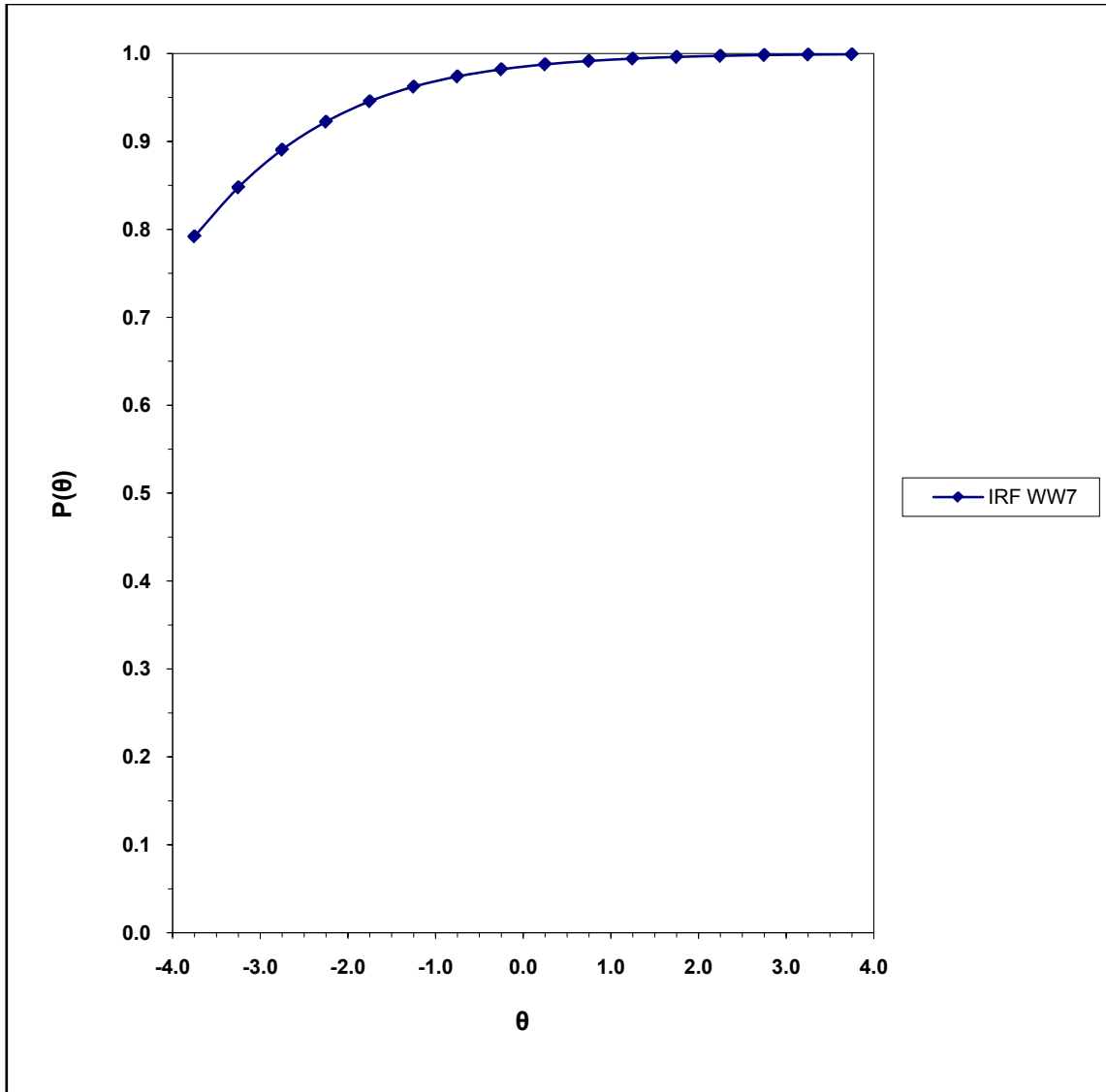


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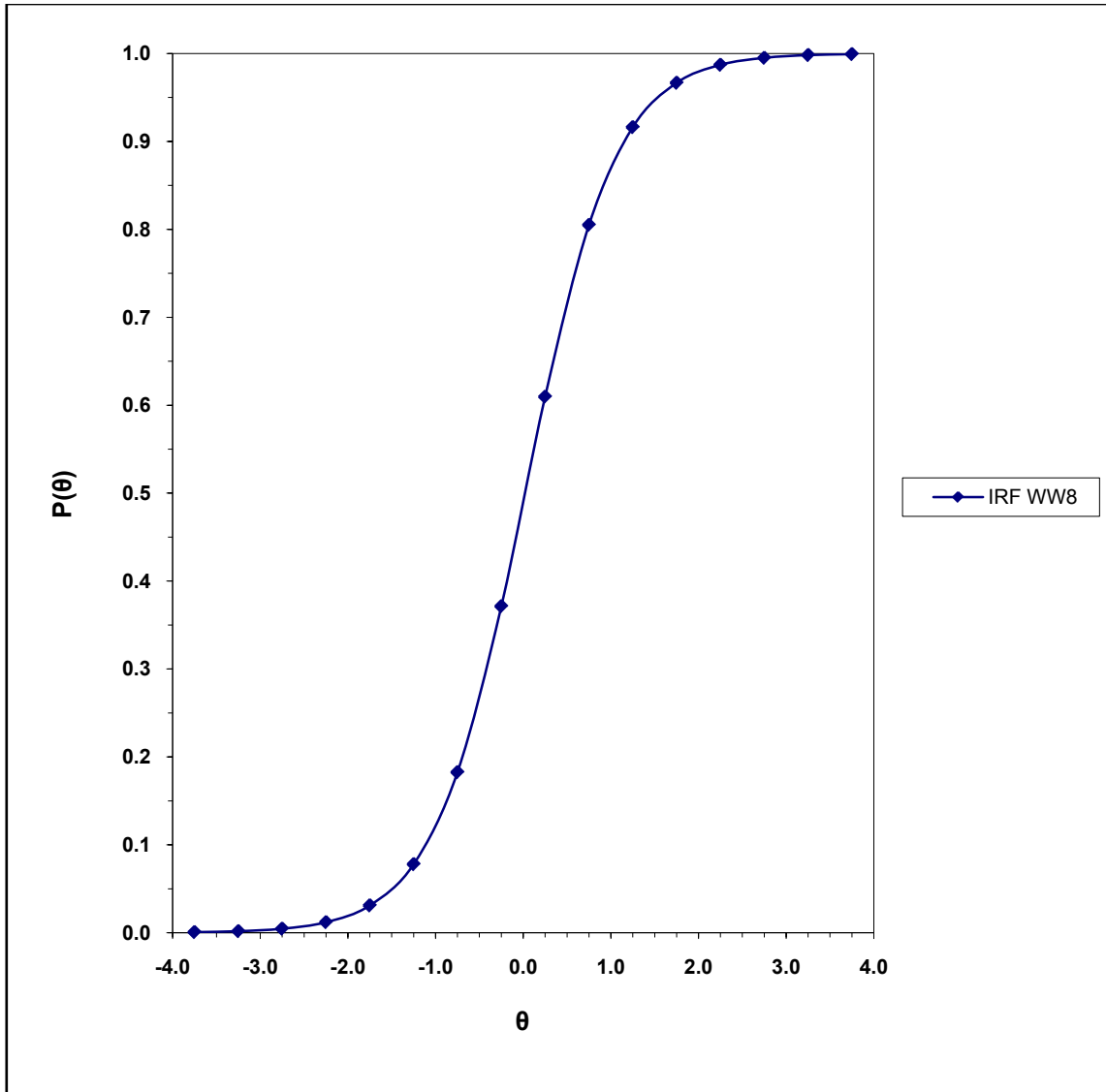


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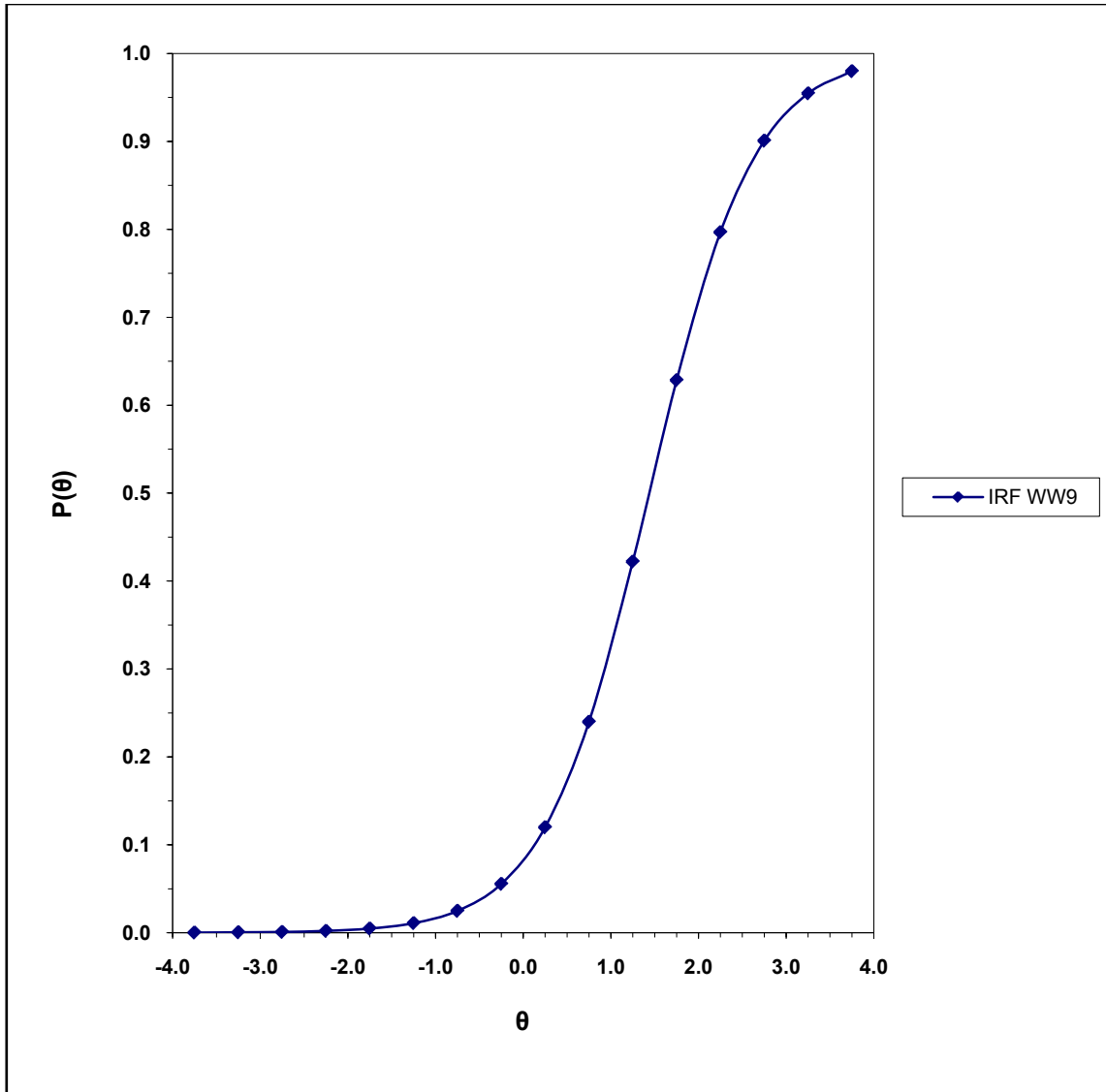


Figure 59 - Fit Plot for Item 59

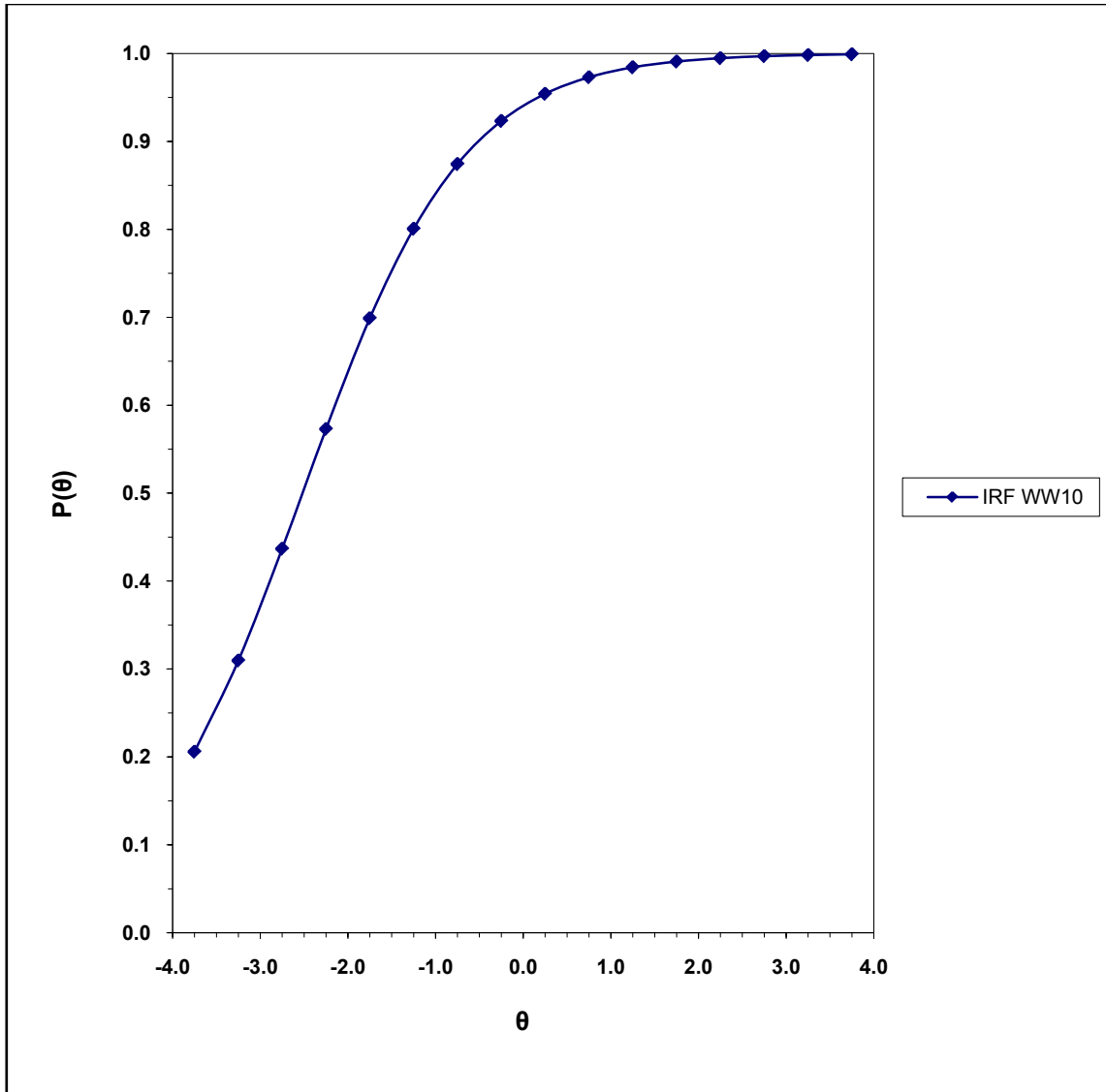


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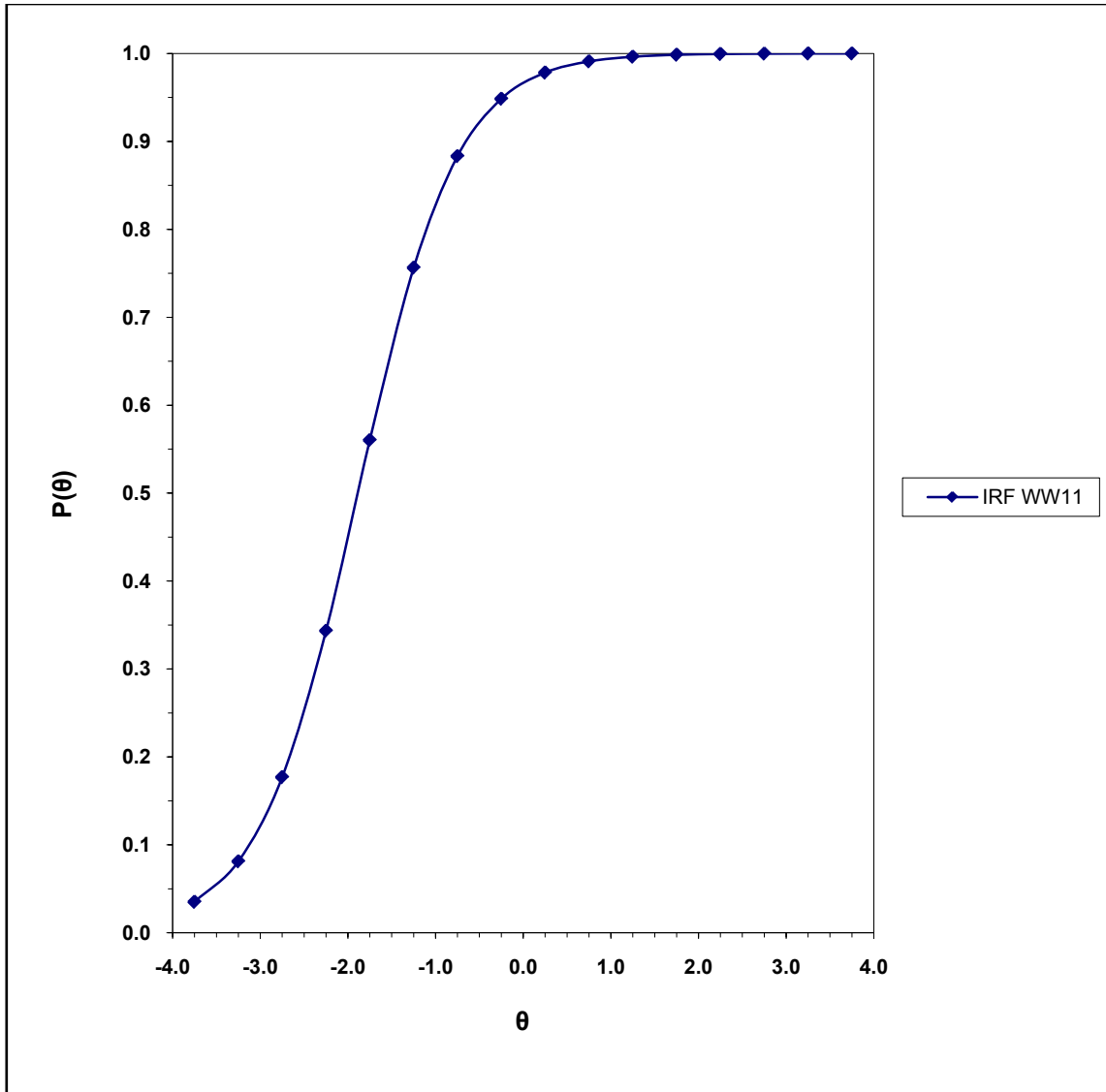


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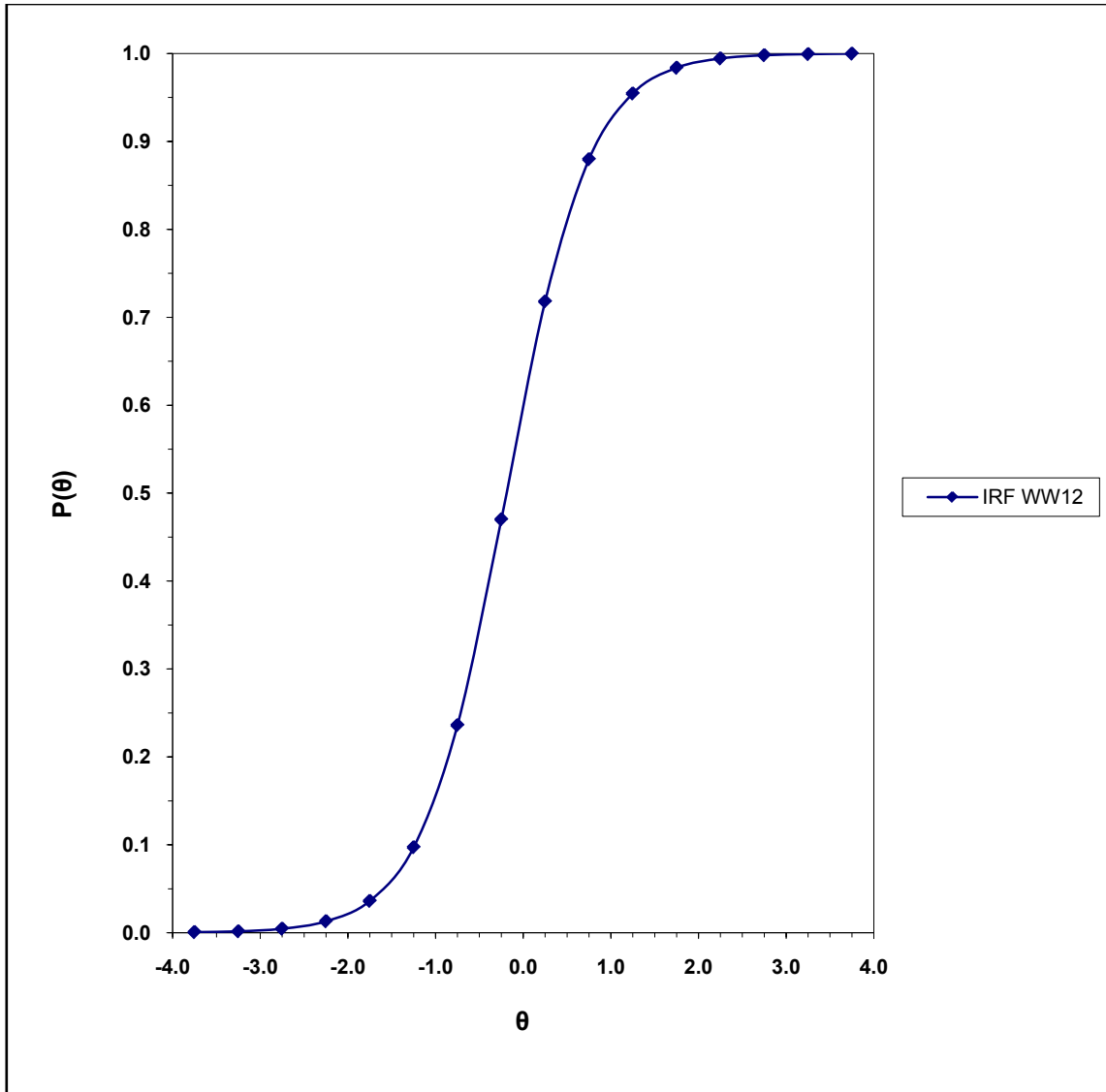


Figure 62 - Fit Plot for Item 62

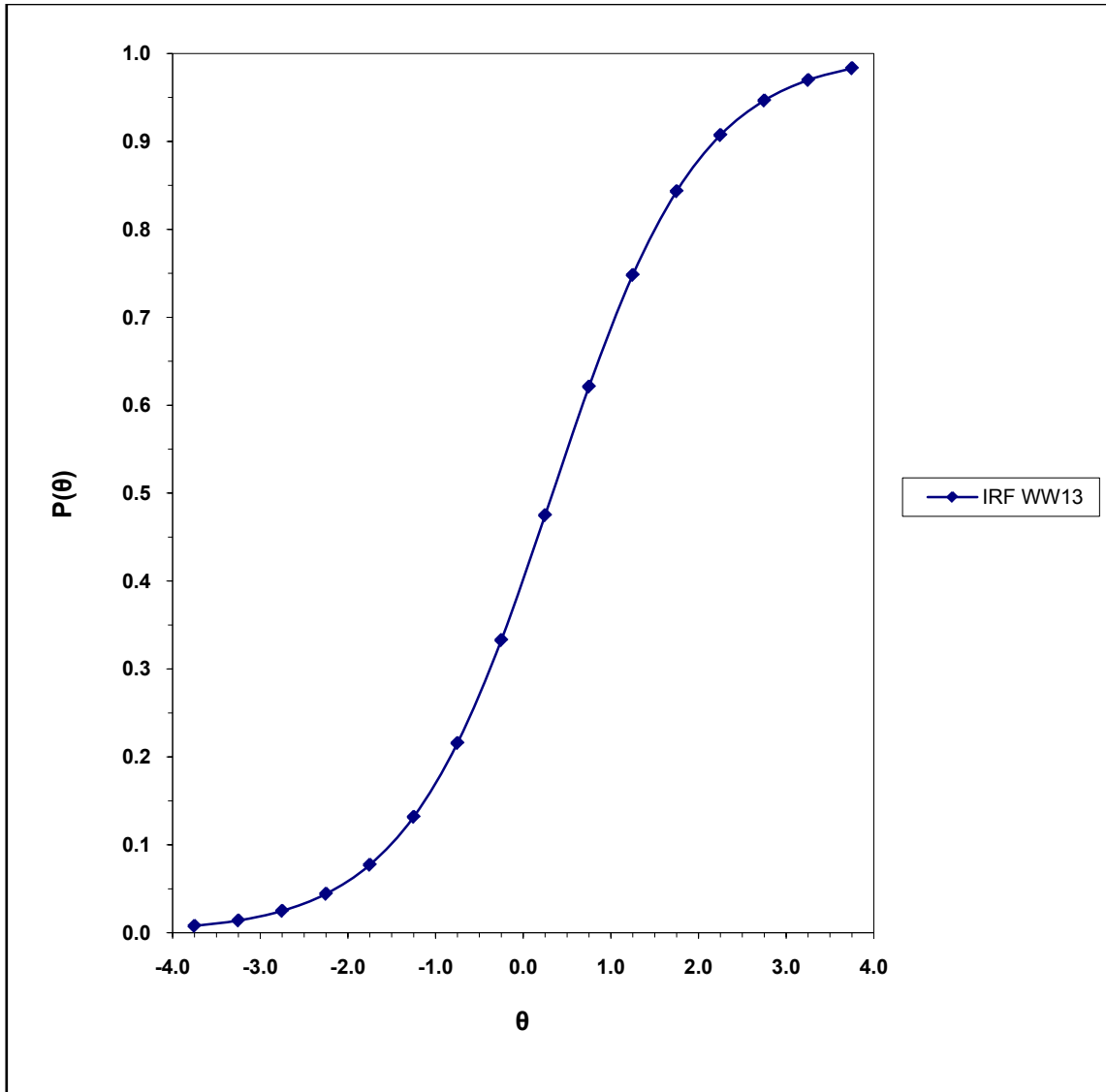


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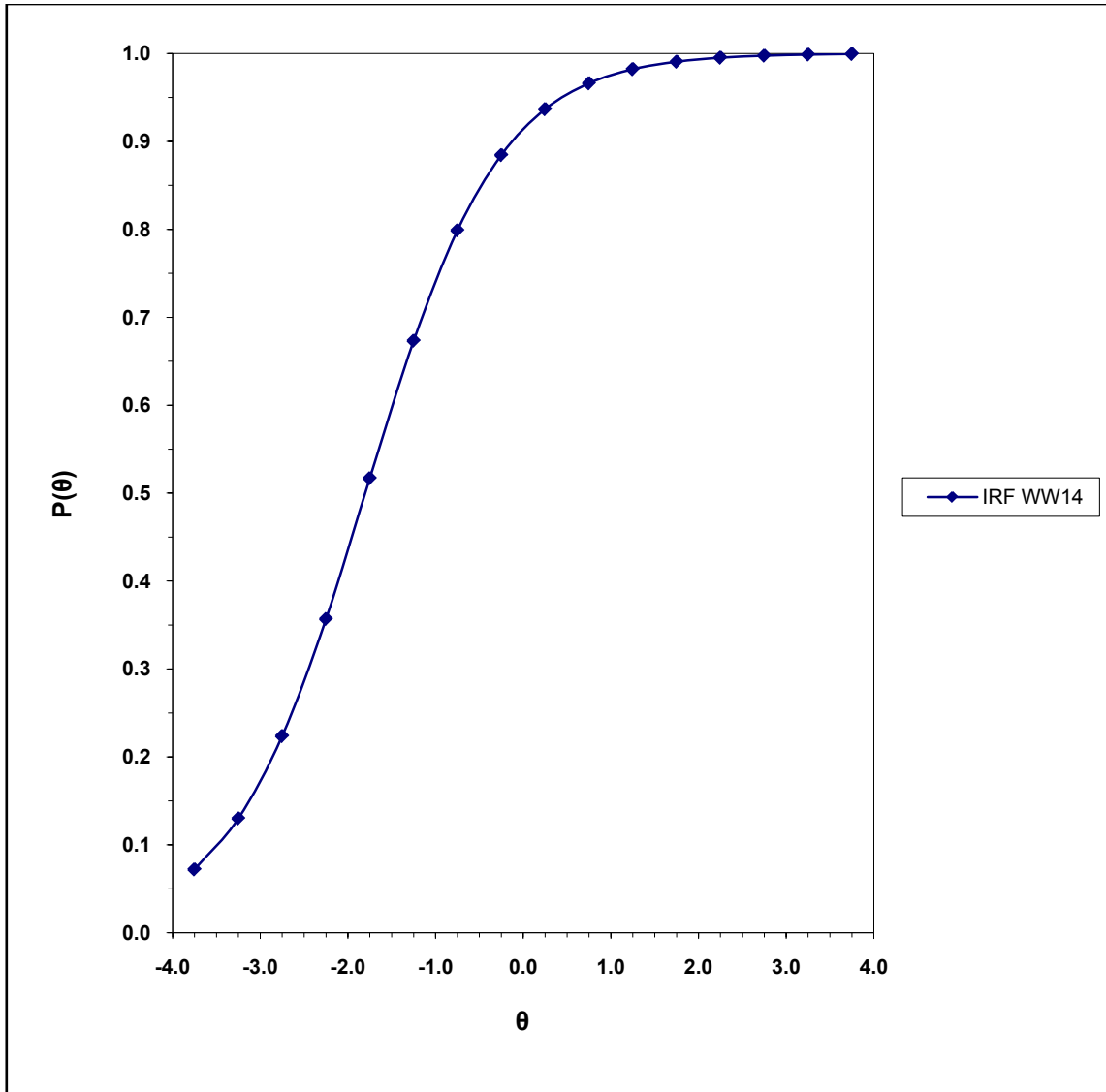


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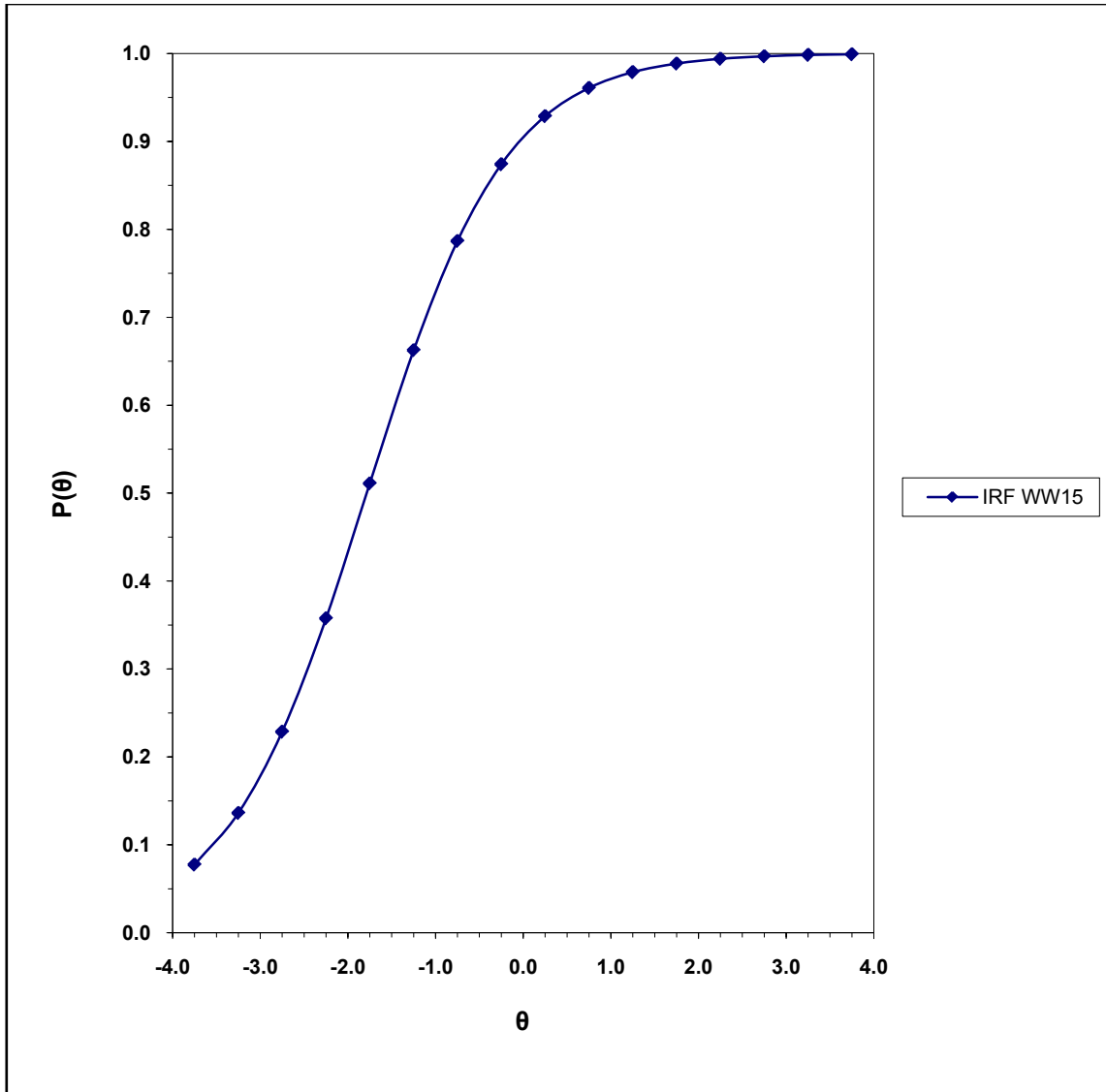


Figure 65 - Fit Plot for Item 65

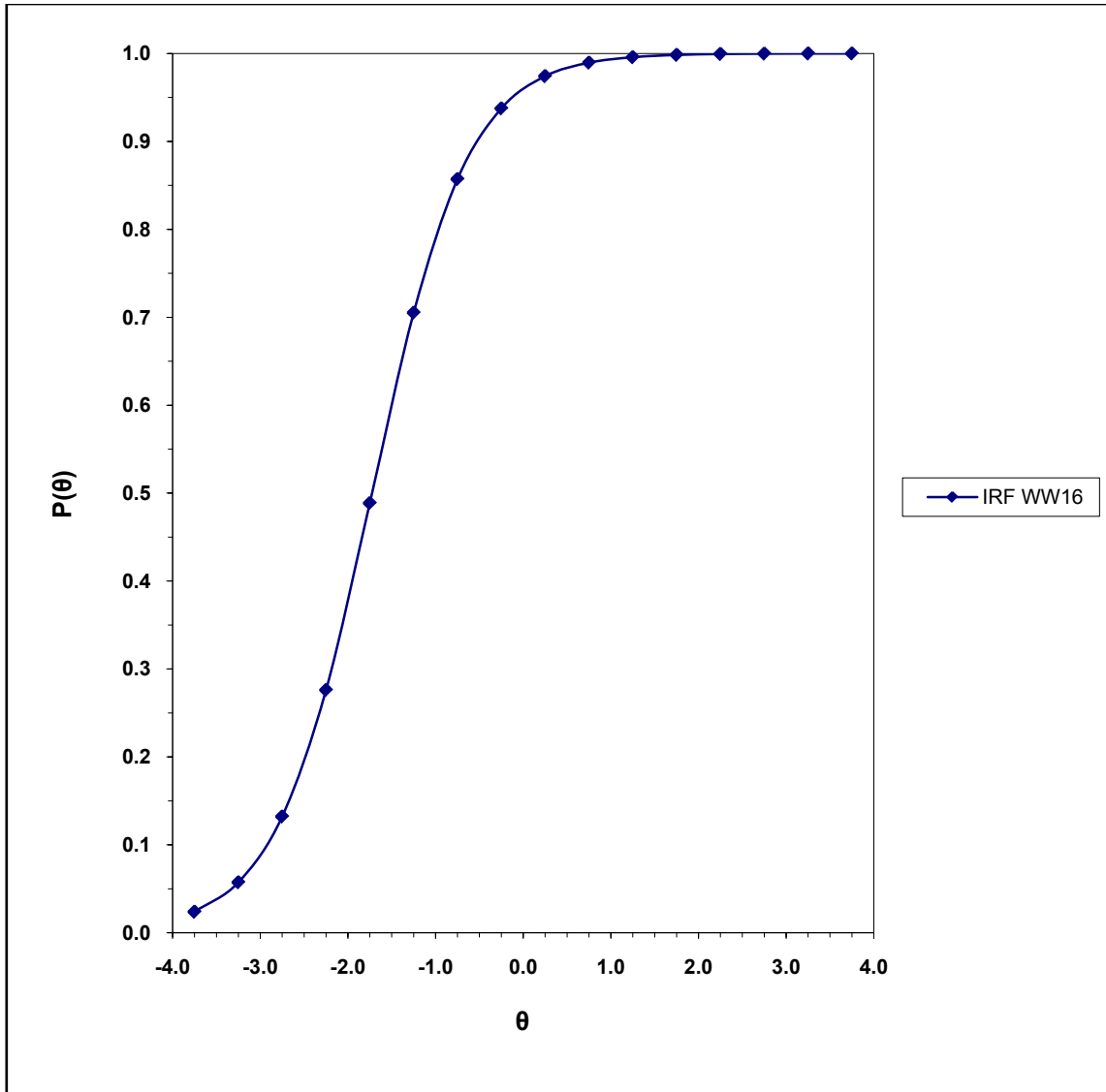


Figure 66 - Fit Plot for Item 66

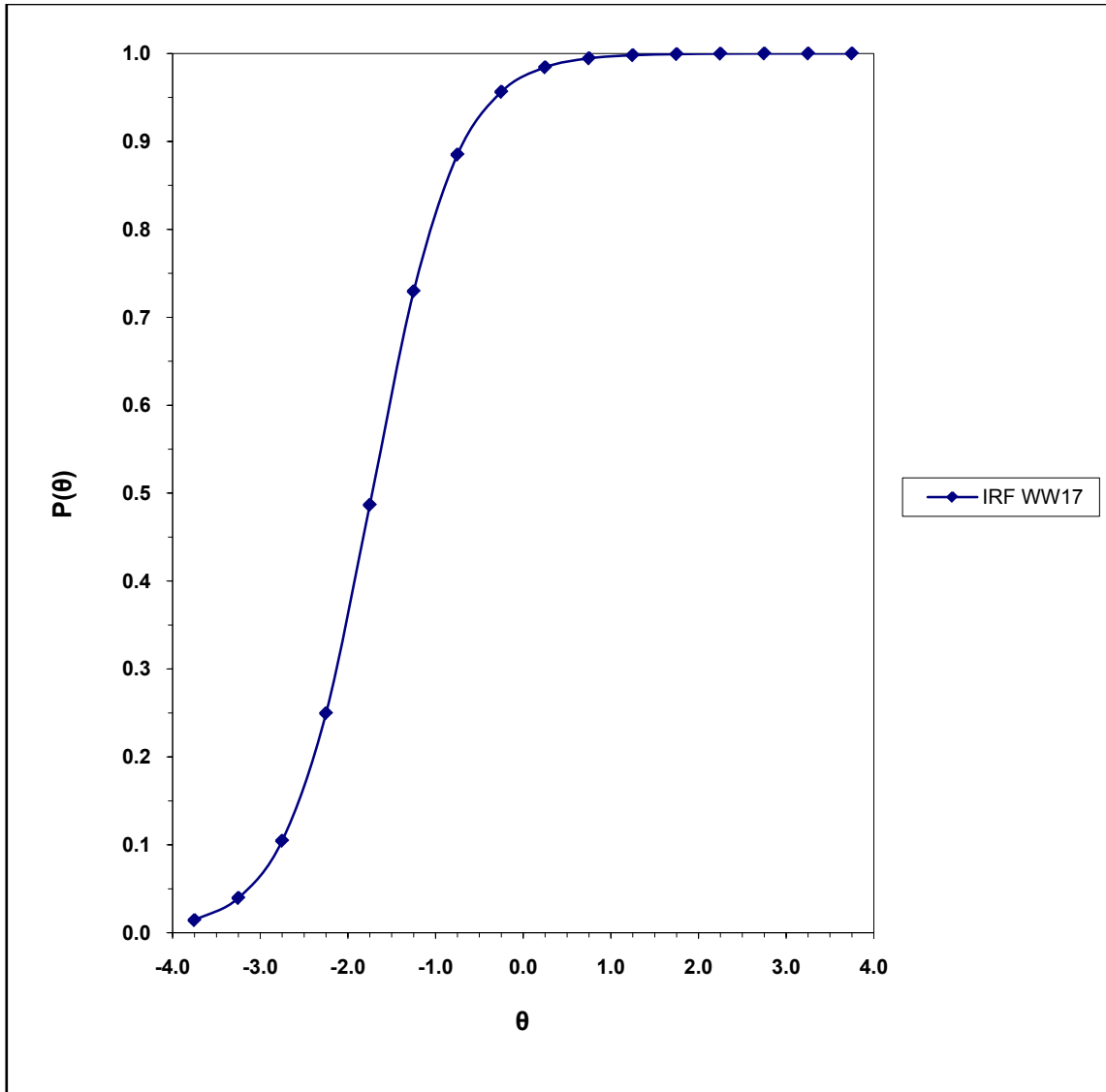


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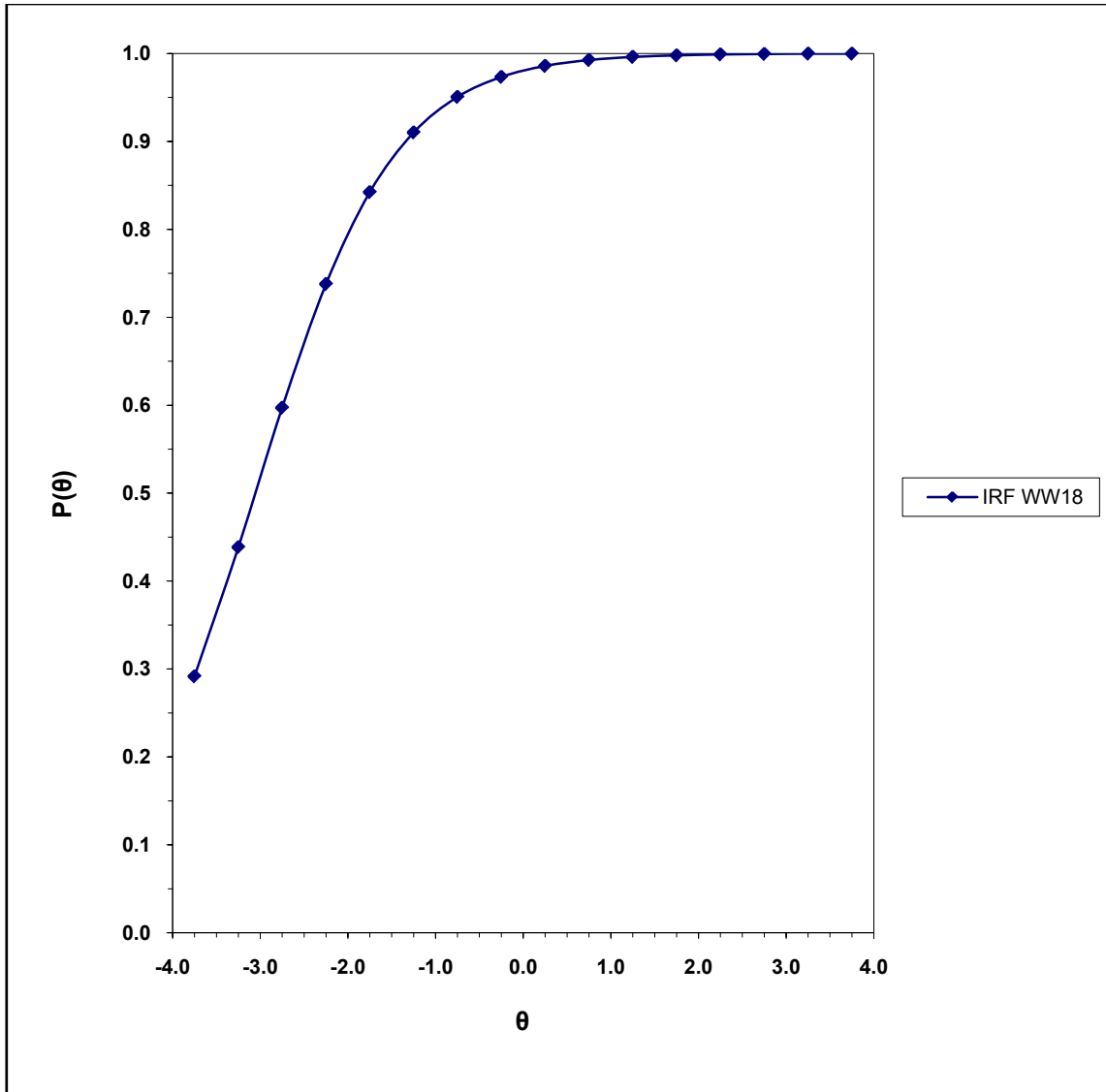


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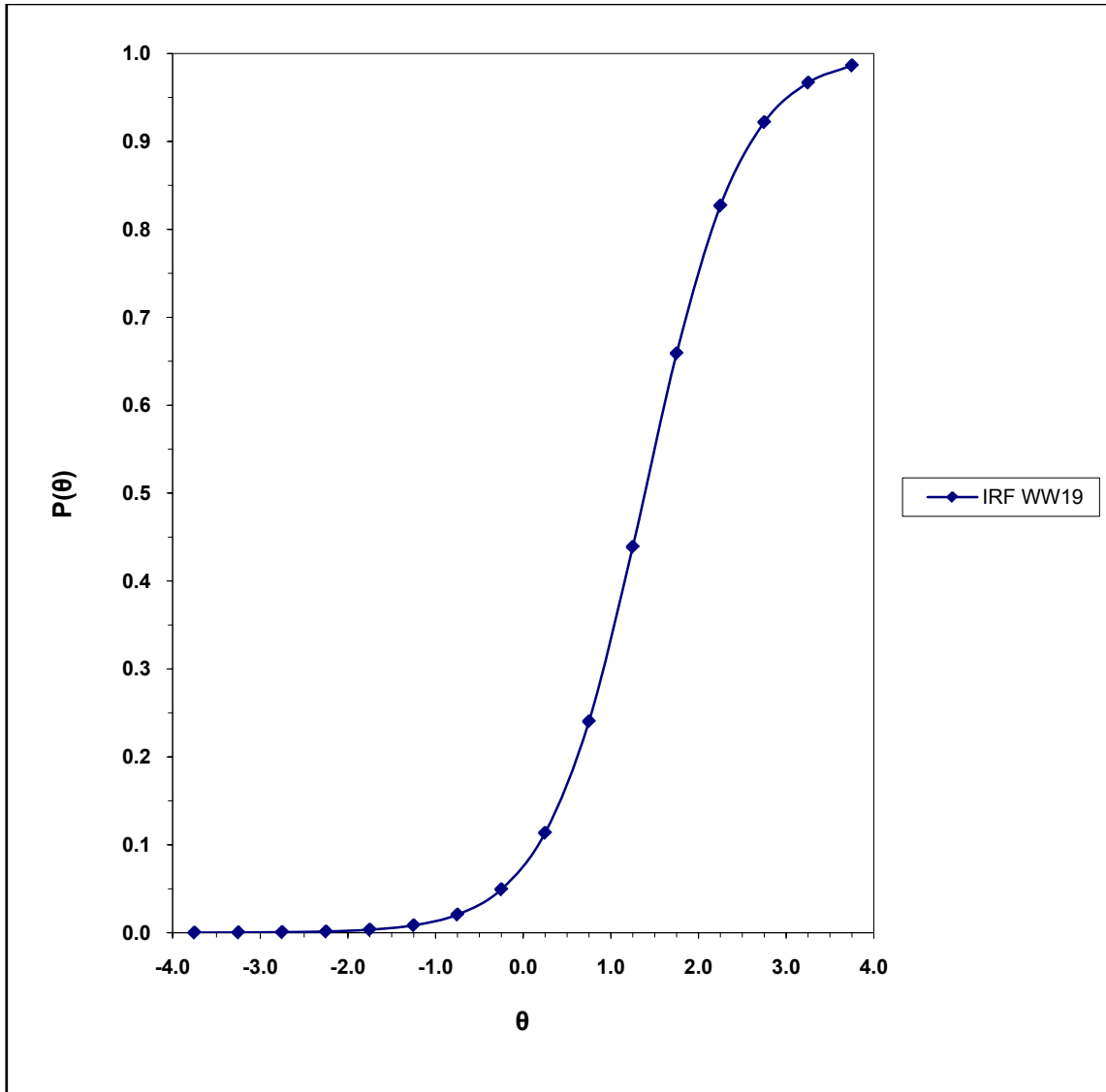


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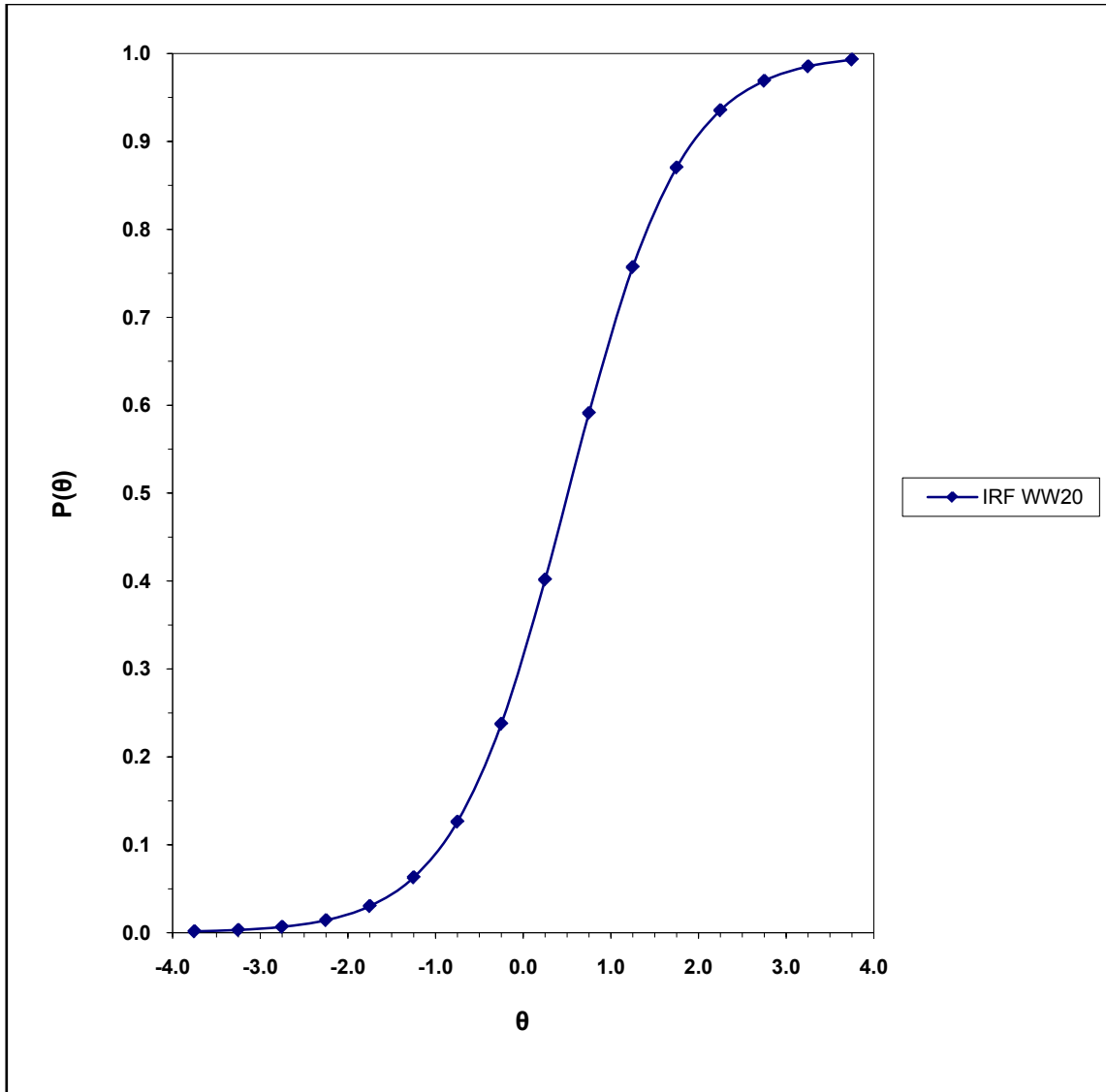


Figure 70 - Fit Plot for Item 70

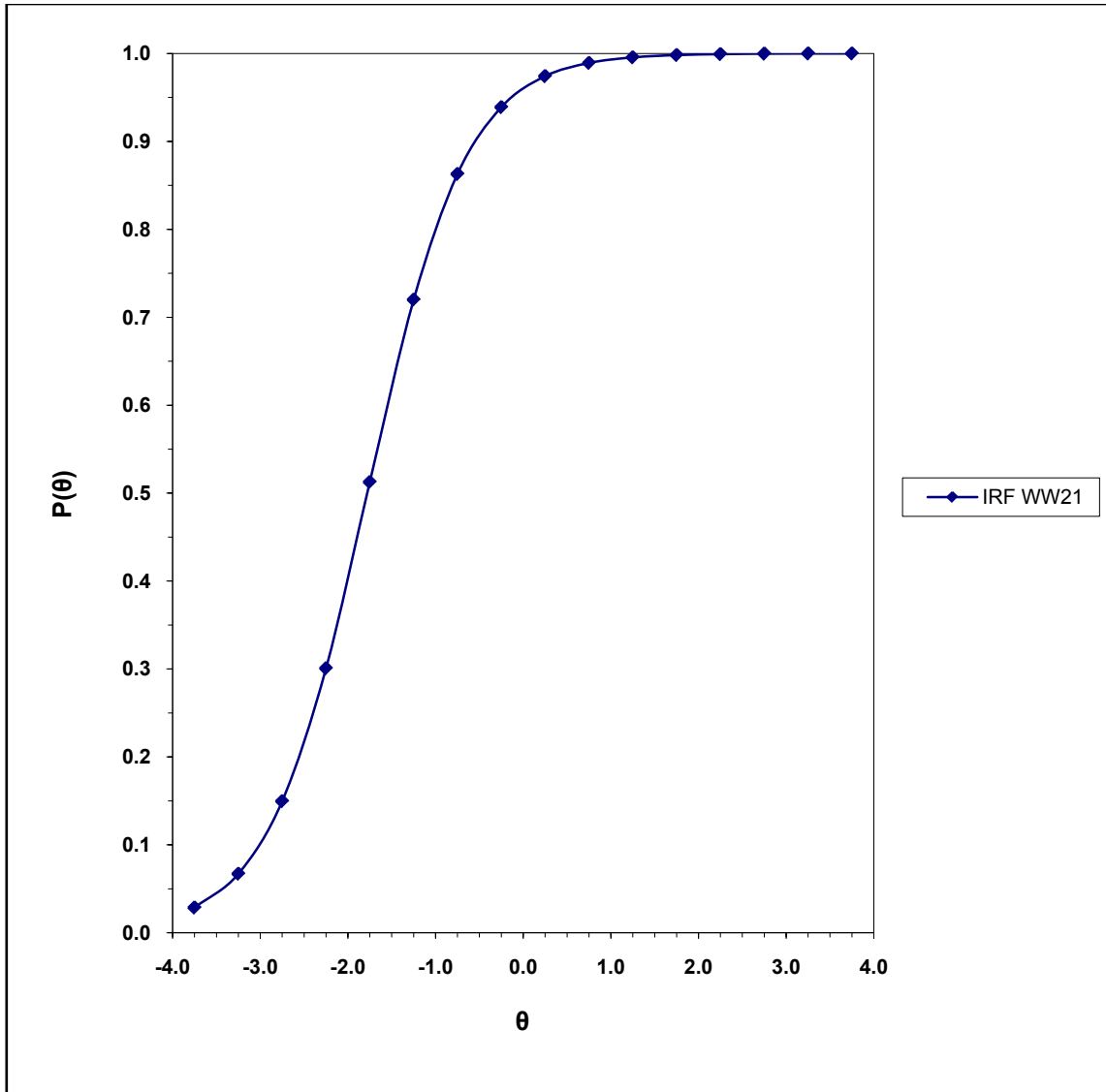


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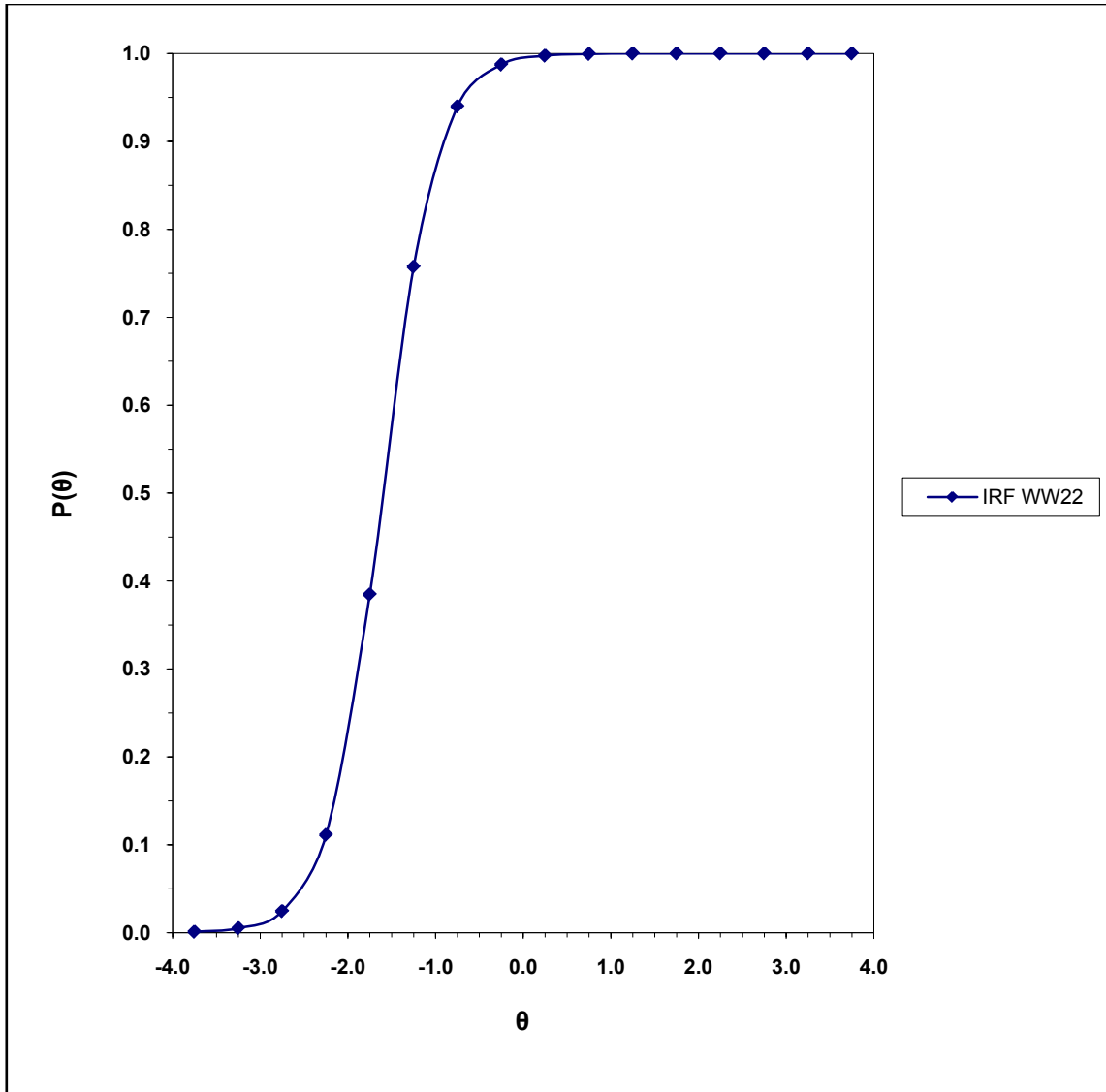


Figure 72 - Fit Plot for Item 72

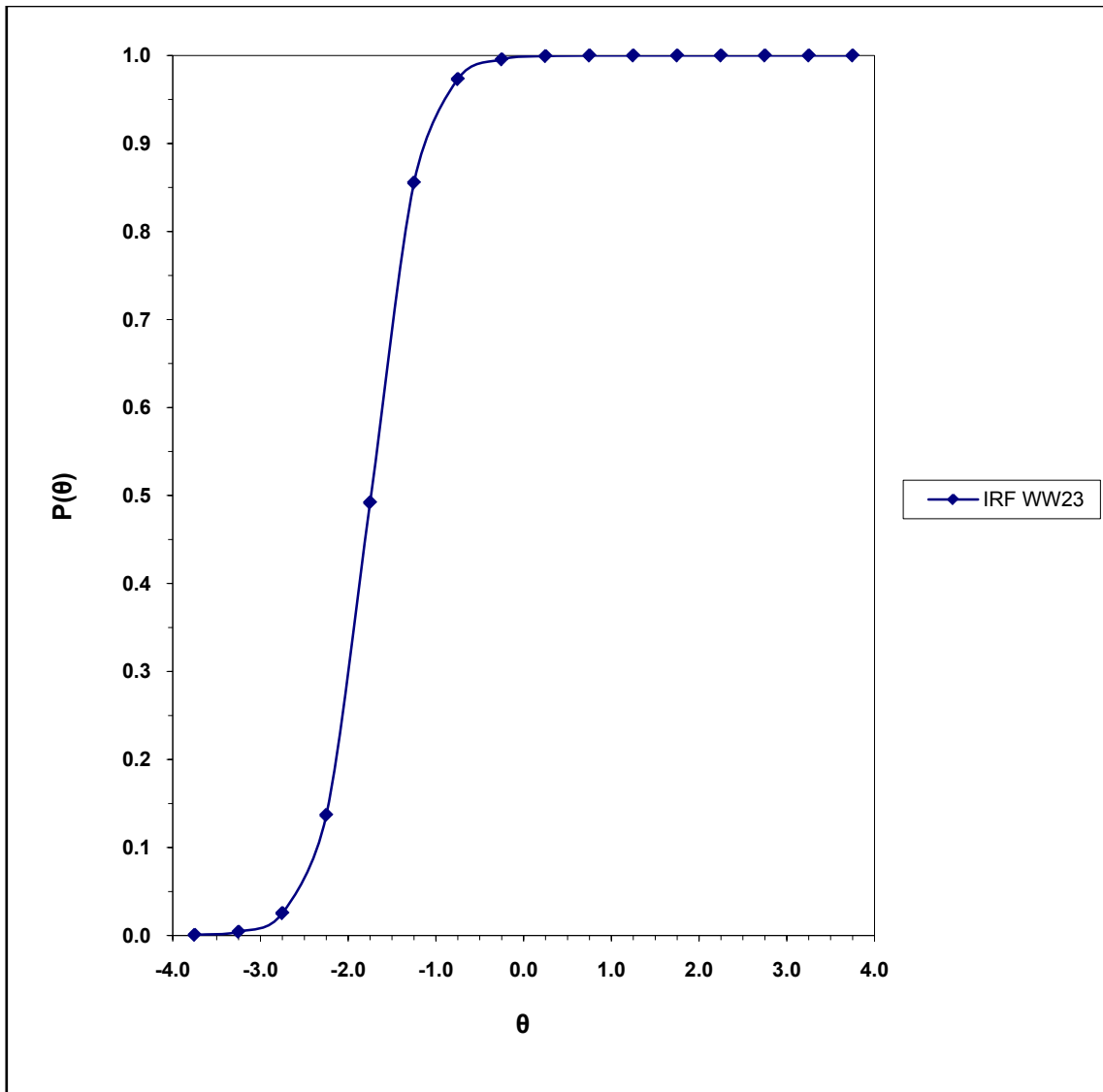


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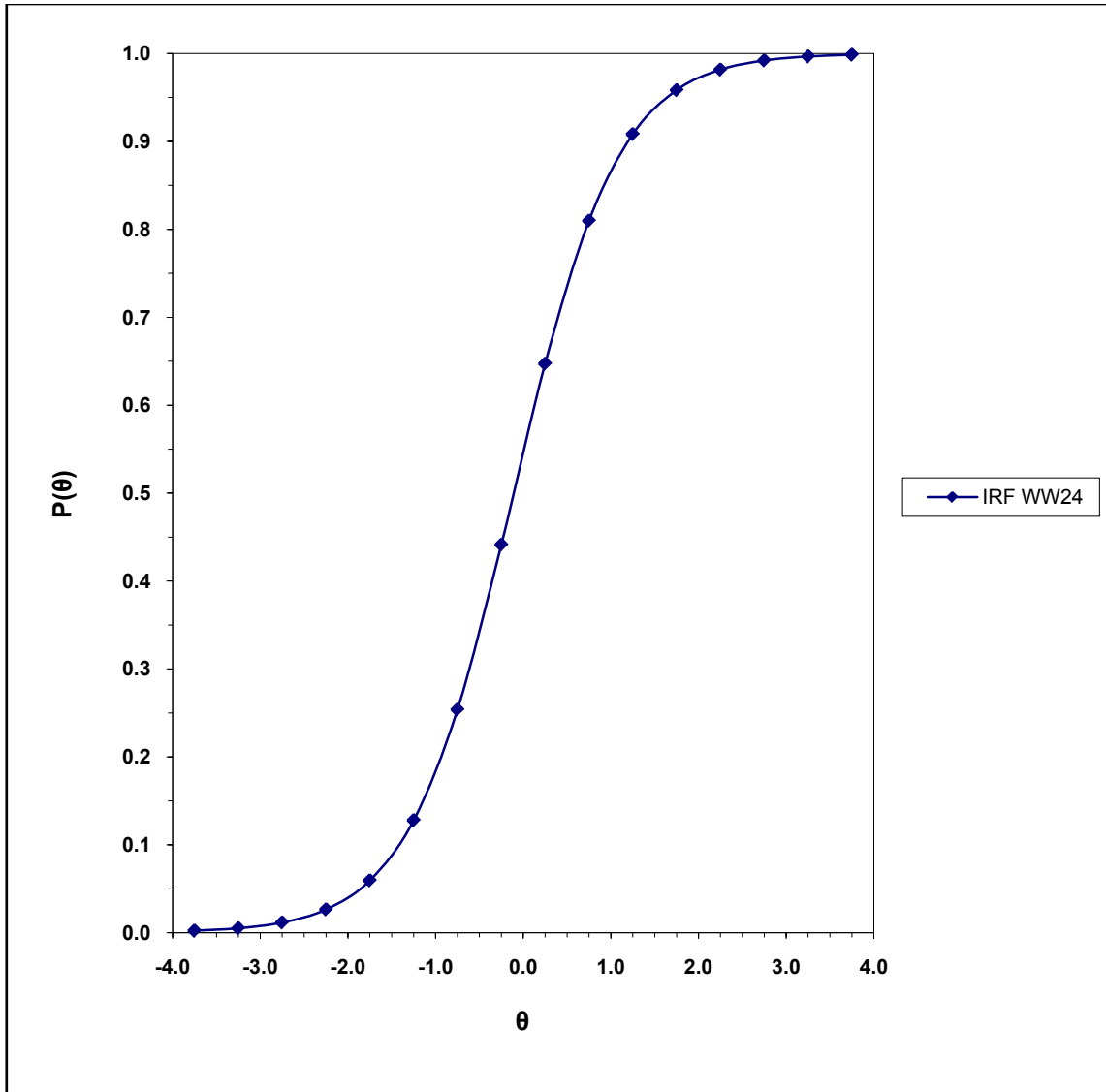


Figure 74 - Fit Plot for Item 74

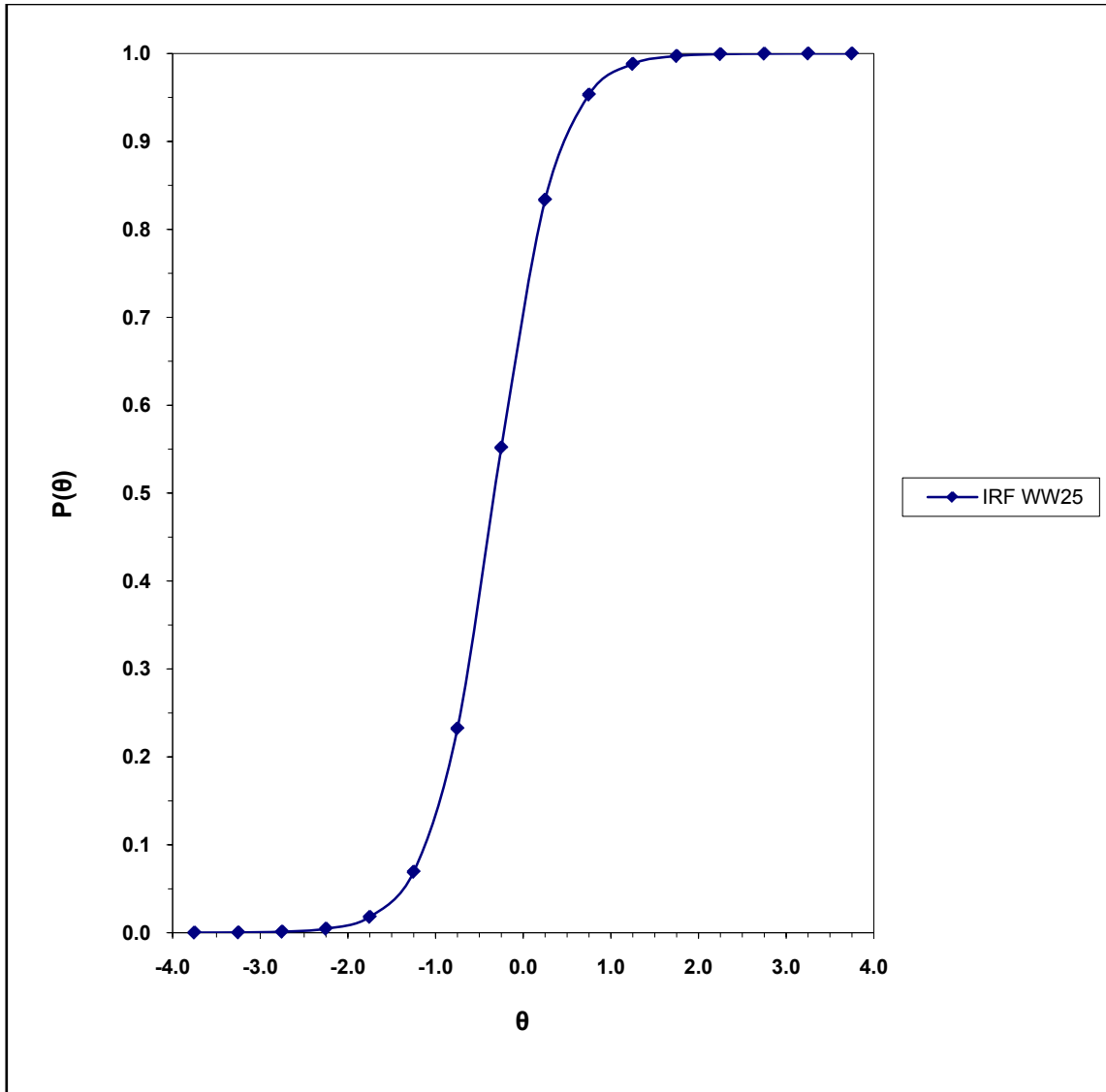


Figure 75 - Fit Plot for Item 75

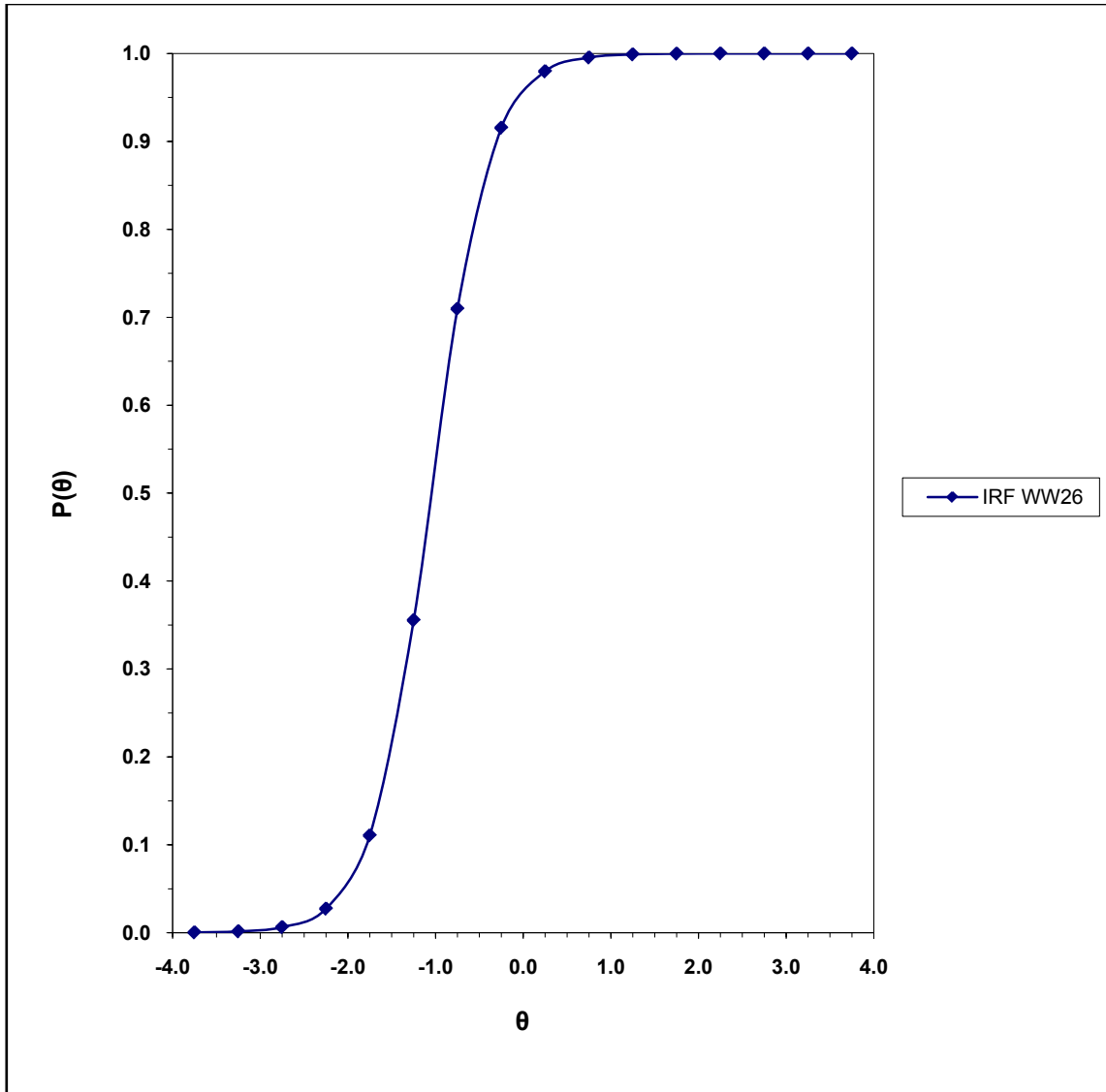


Figure 76 - Fit Plot for Item 76

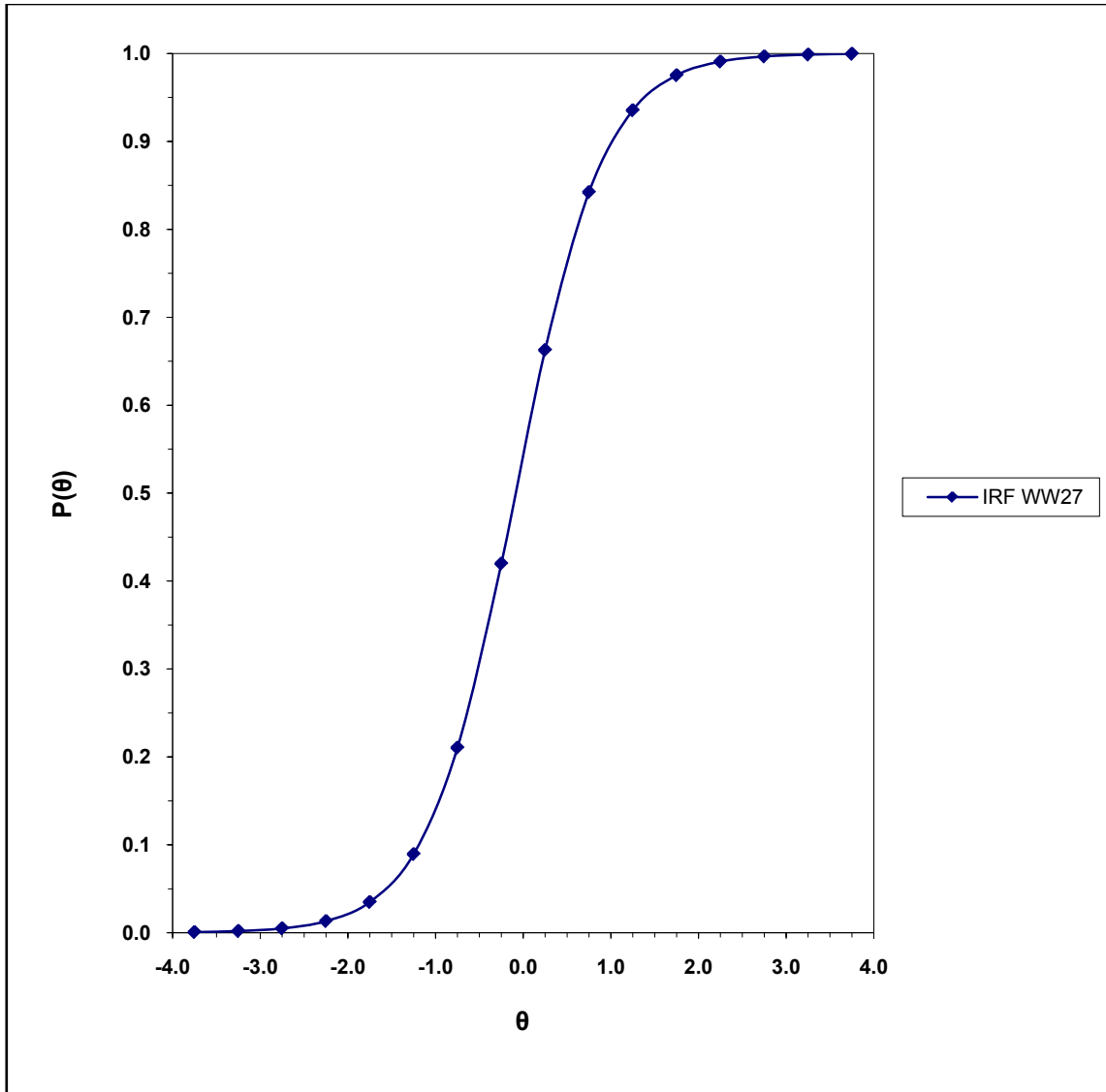


Figure 77 - Fit Plot for Item 77

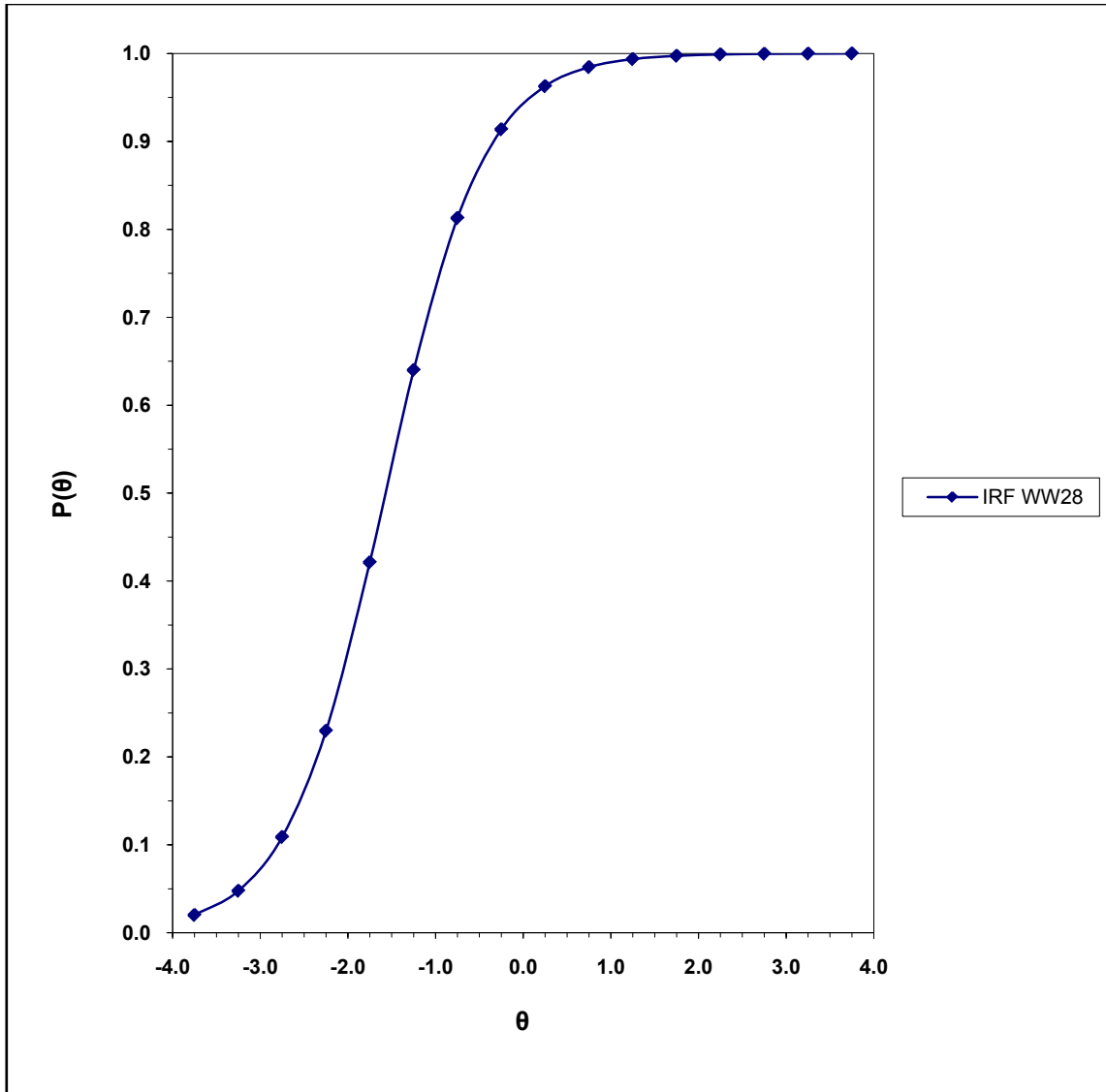


Figure 78 - Fit Plot for Item 78

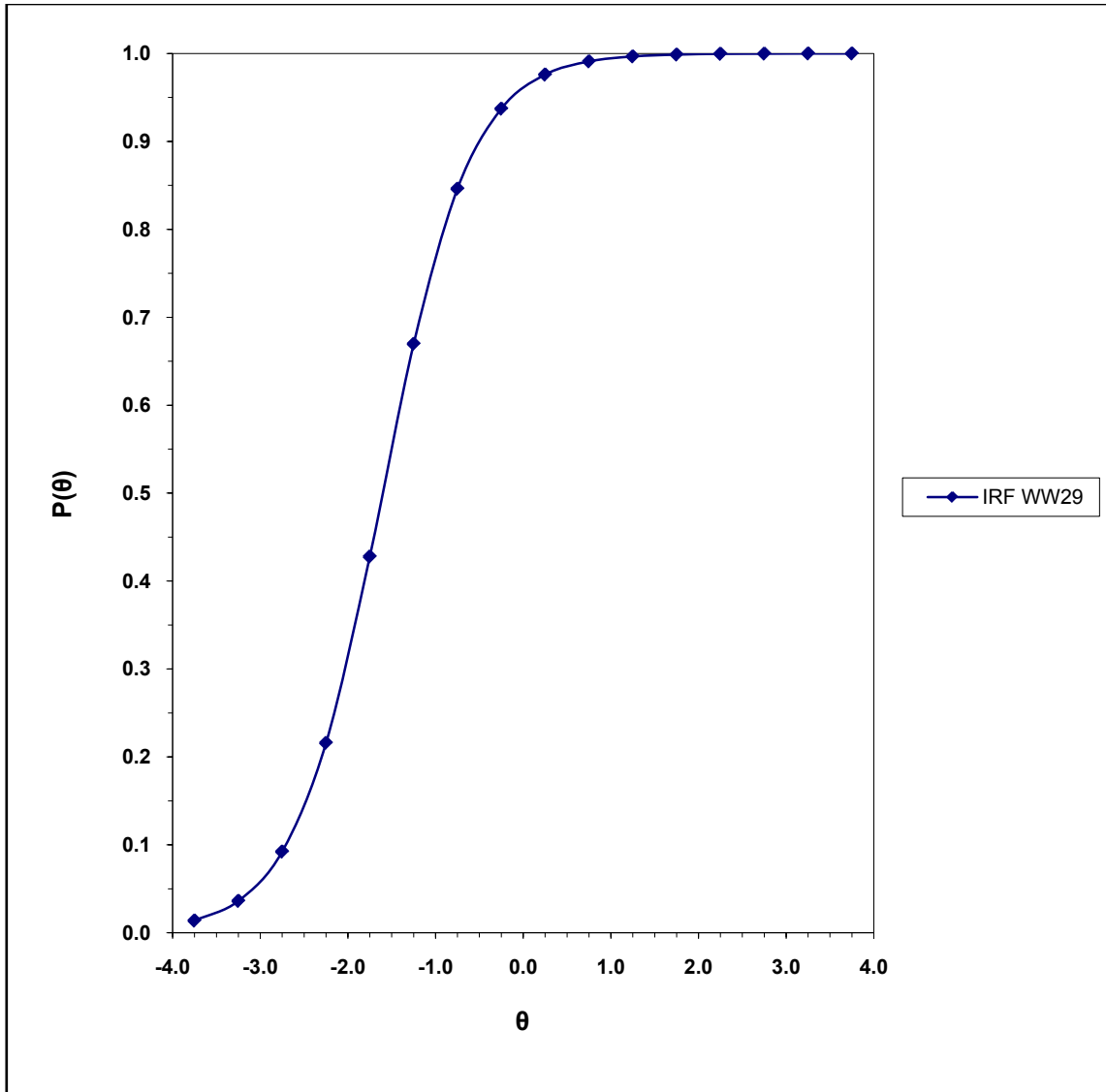


Figure 79 - Fit Plot for Item 79

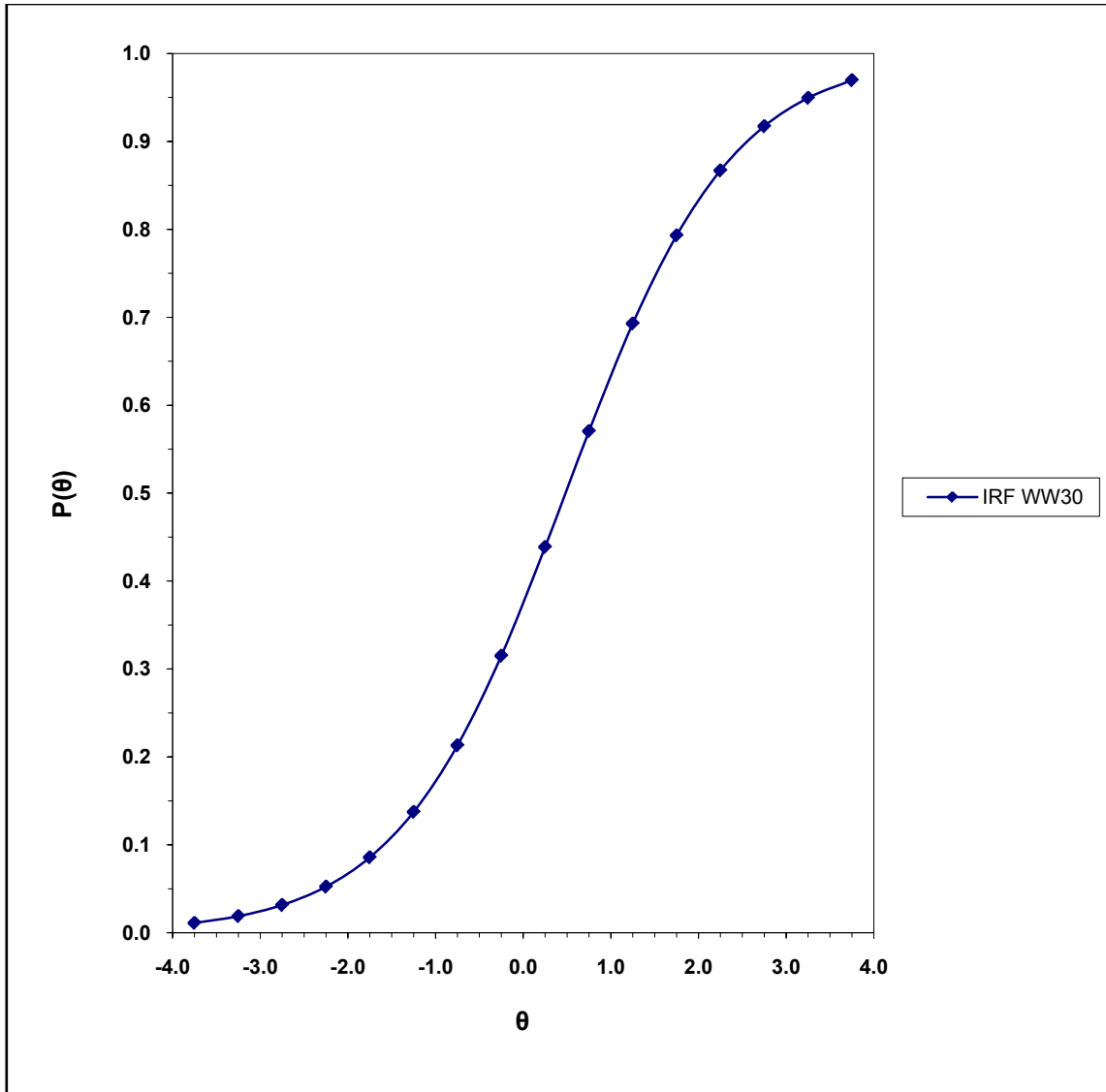


Figure 80 - Fit Plot for Item 80

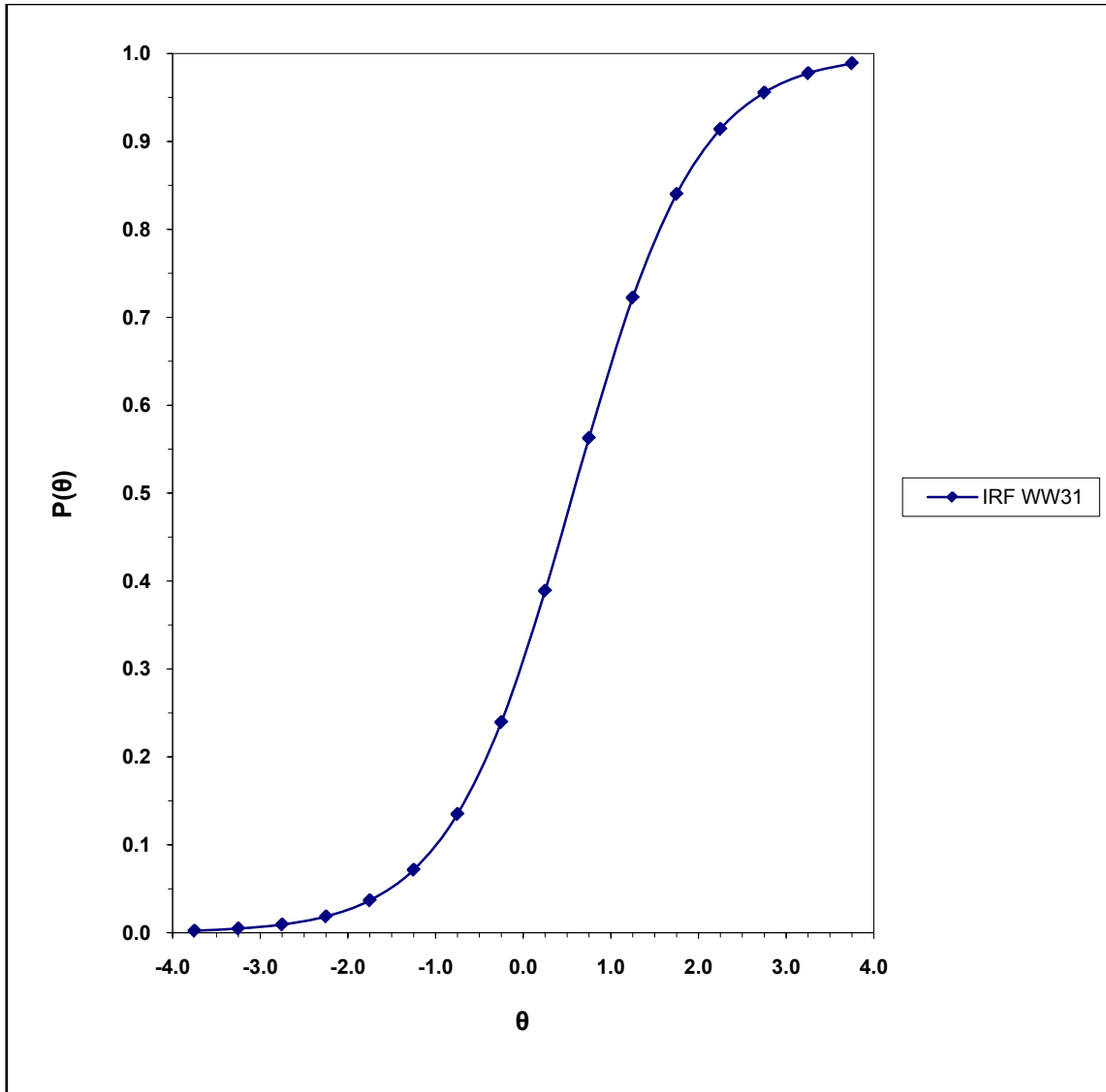


Figure 81 - Fit Plot for Item 81

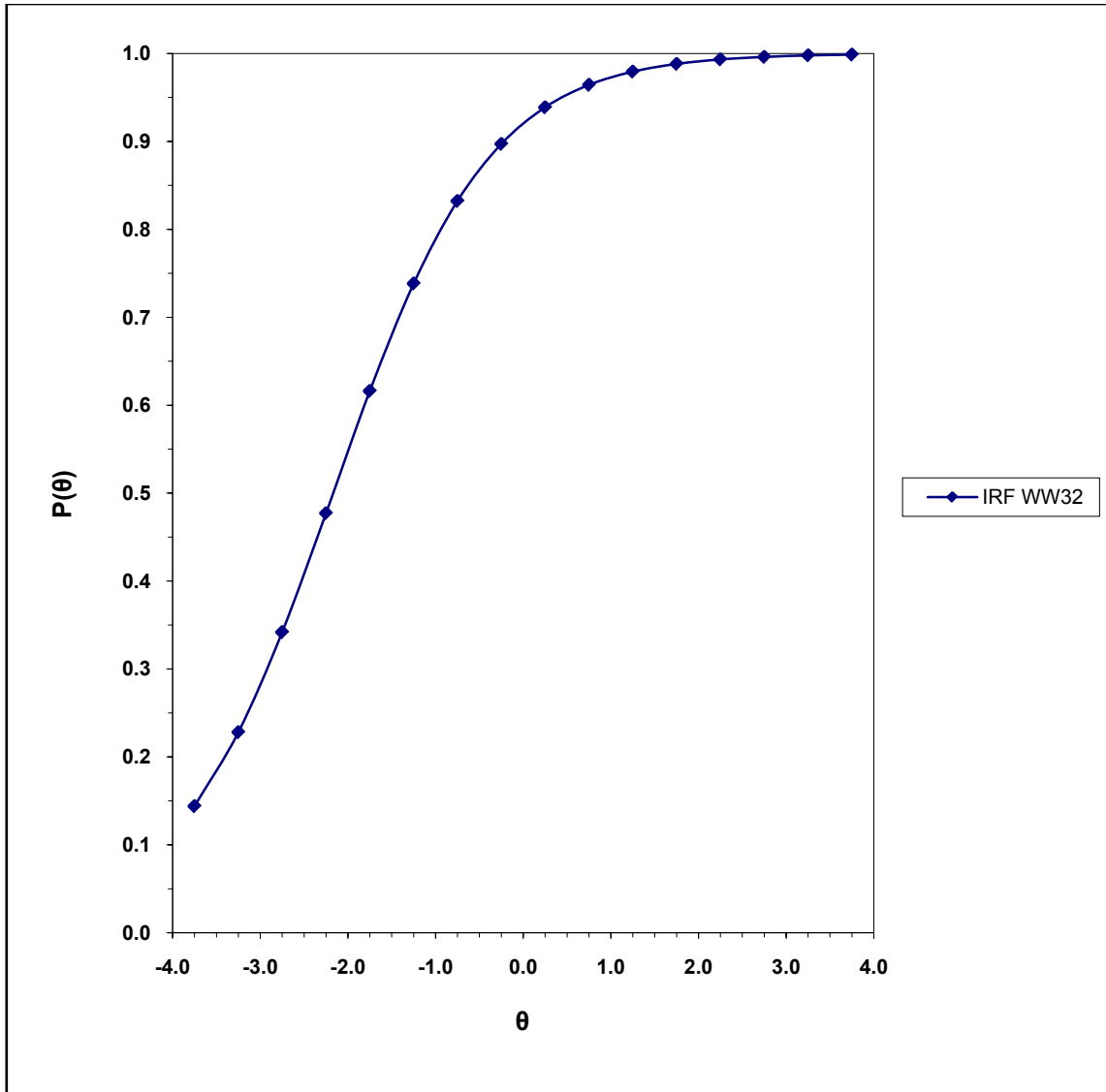


Figure 82 - Fit Plot for Item 82

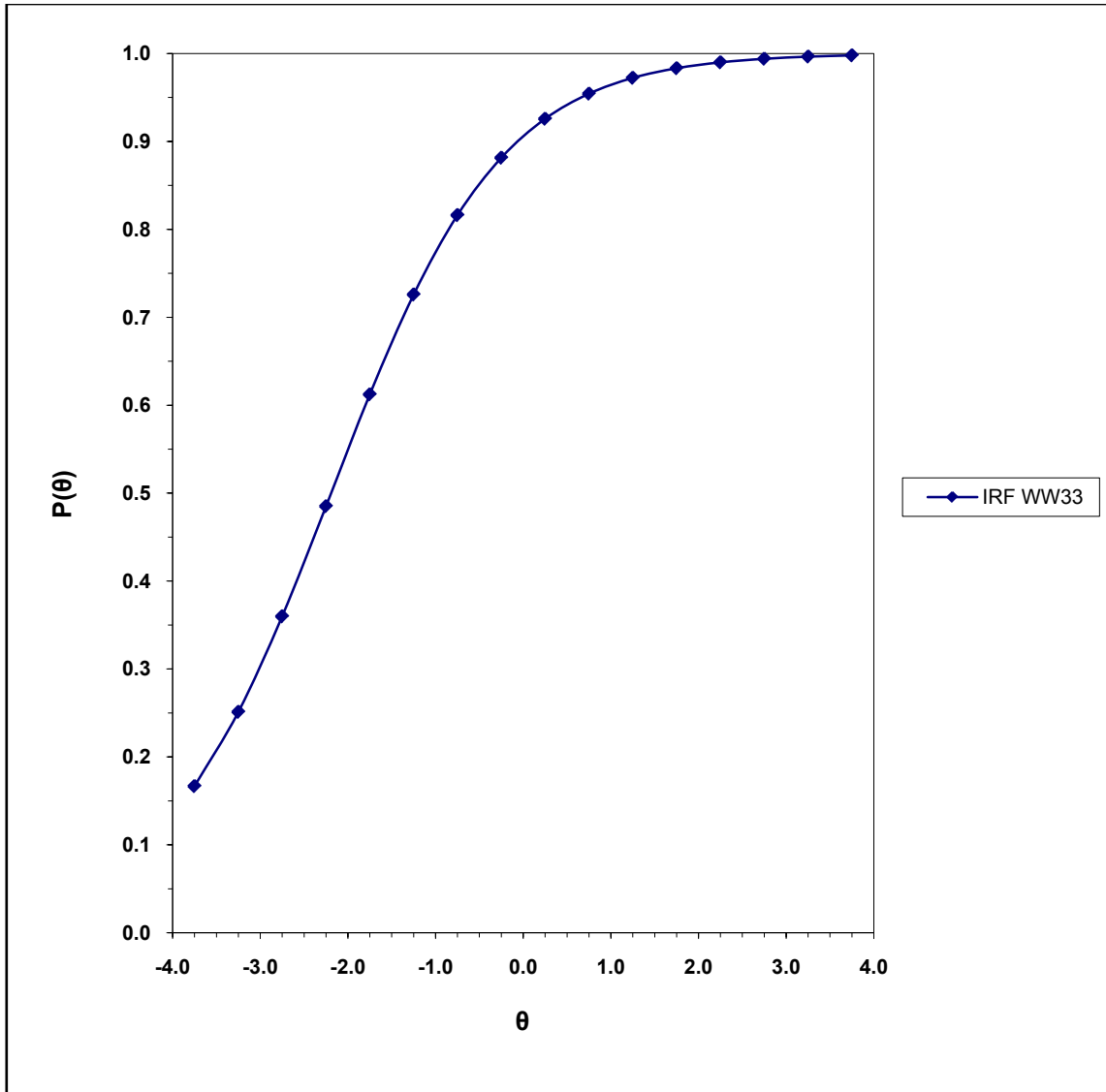


Figure 83 - Fit Plot for Item 83

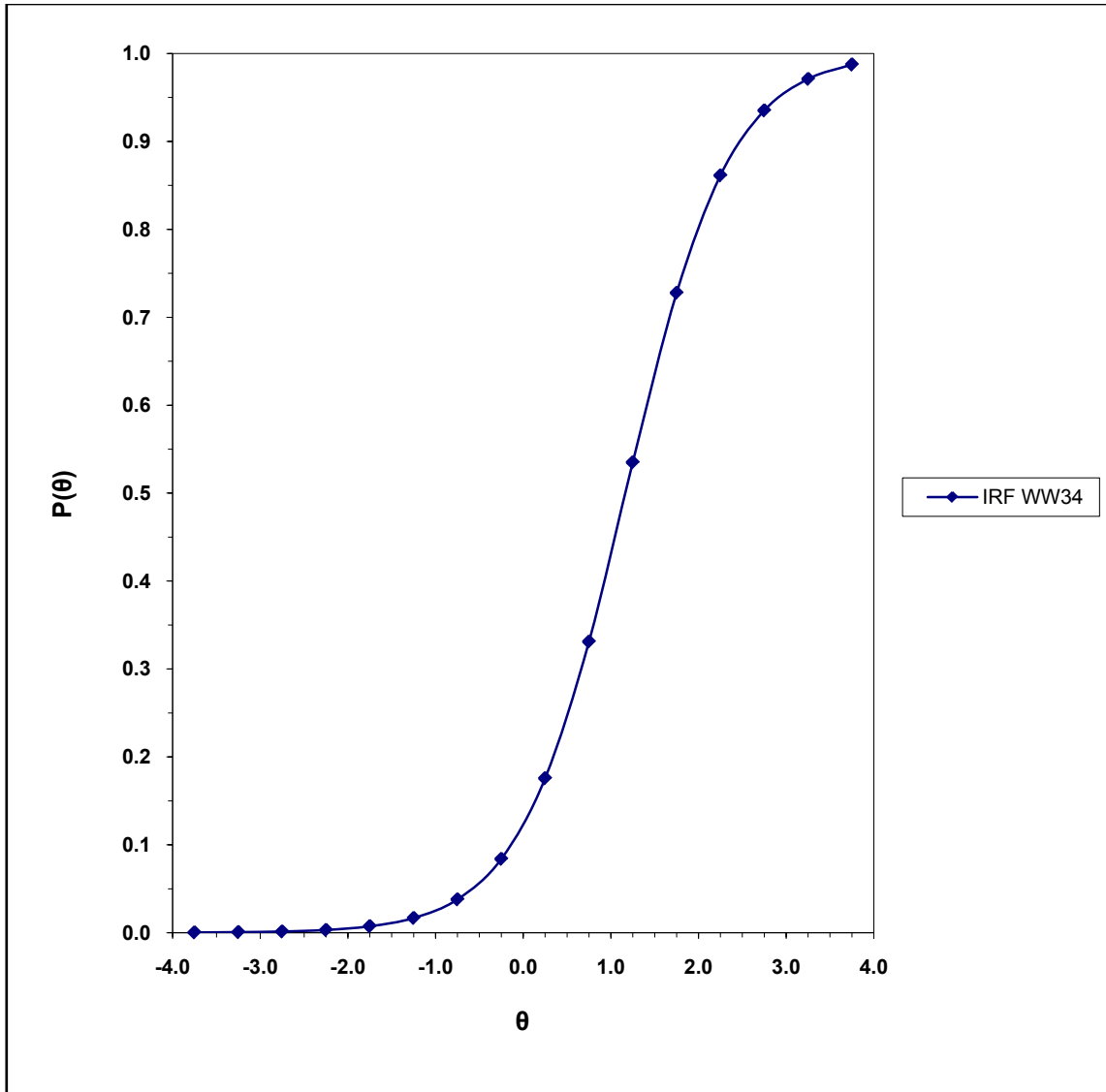


Figure 84 - Fit Plot for Item 84

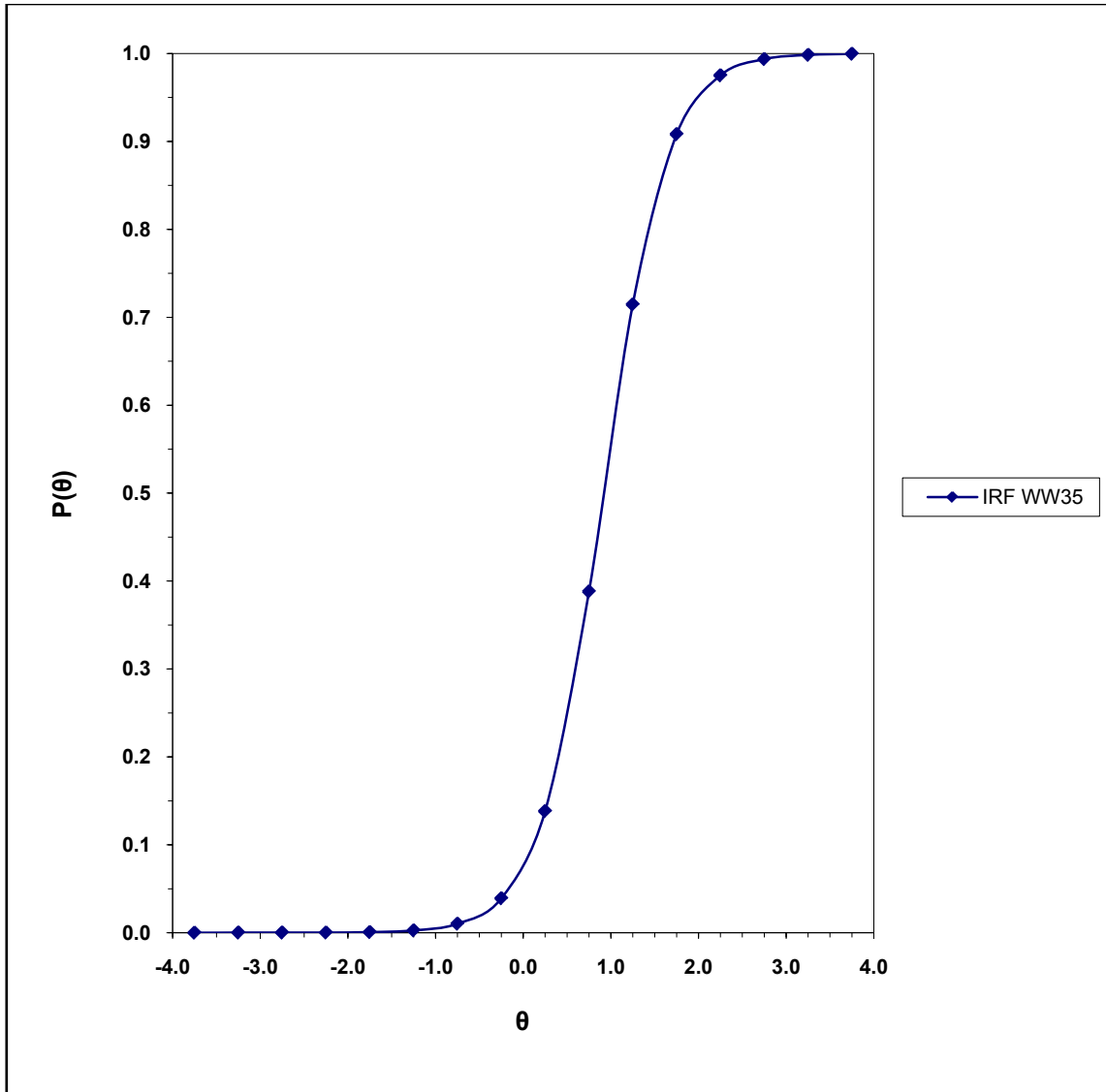


Figure 85 - Fit Plot for Item 85

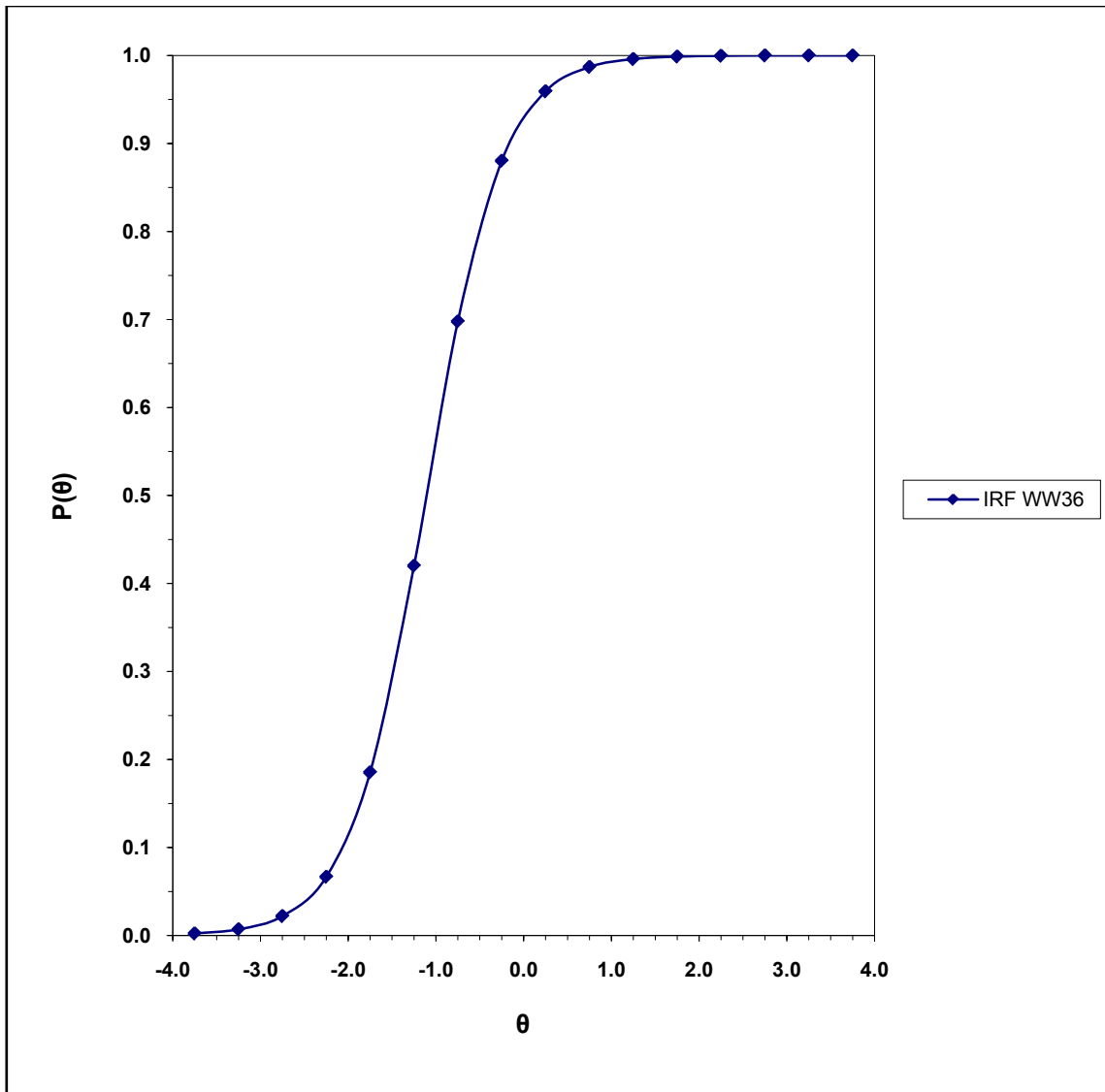


Figure 86 - Fit Plot for Item 86

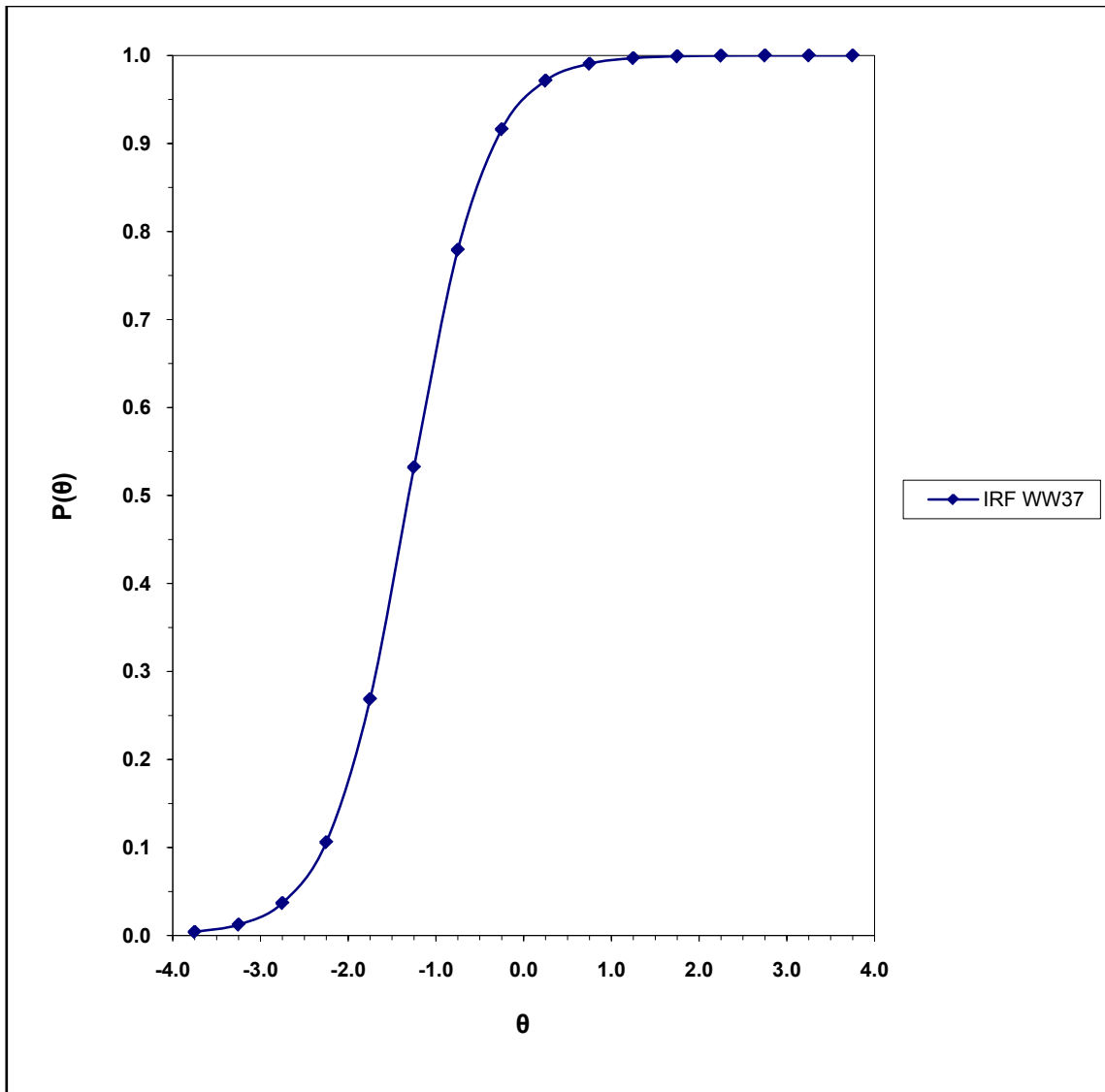


Figure 87 - Fit Plot for Item 87

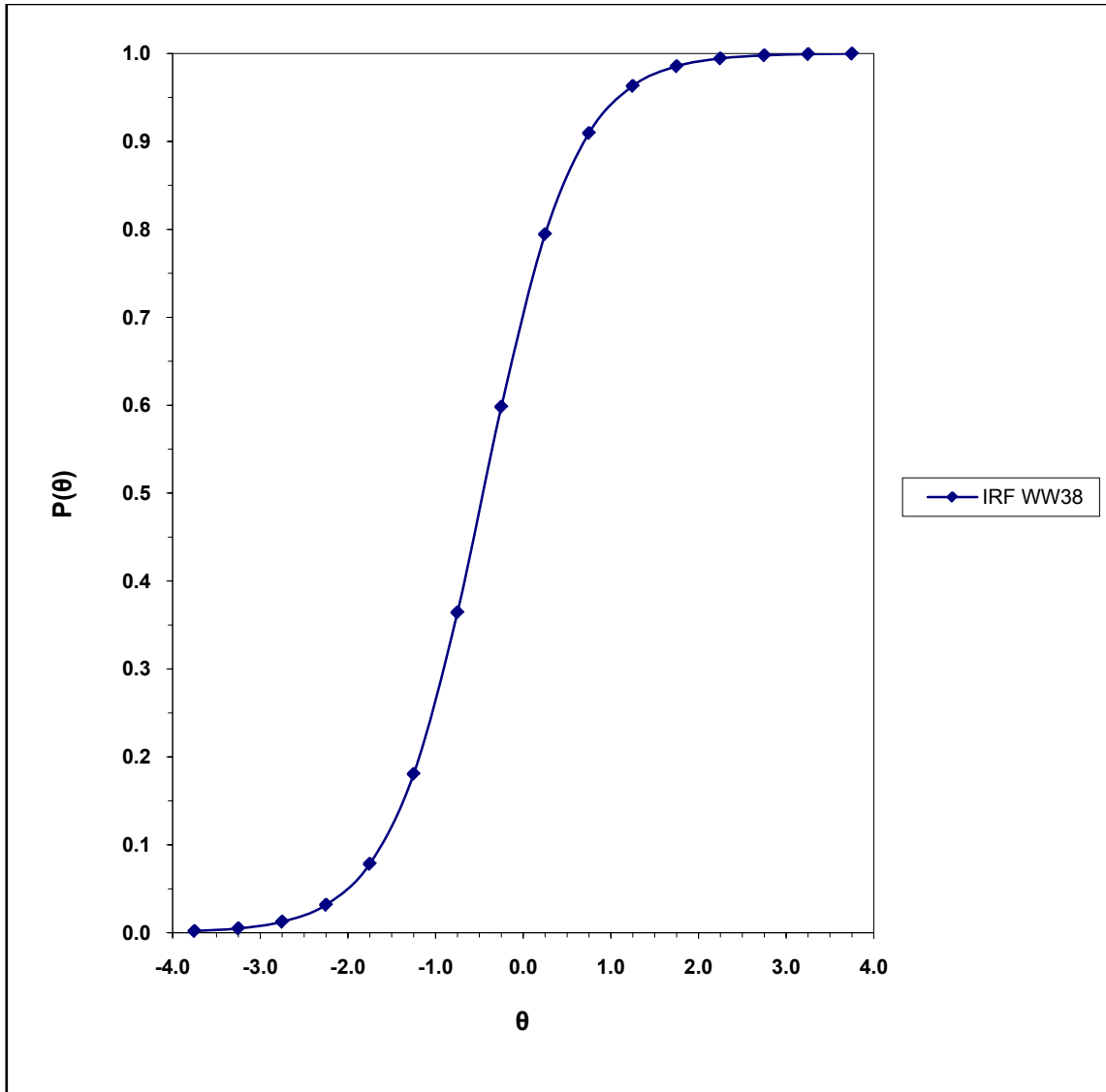


Figure 88 - Fit Plot for Item 88

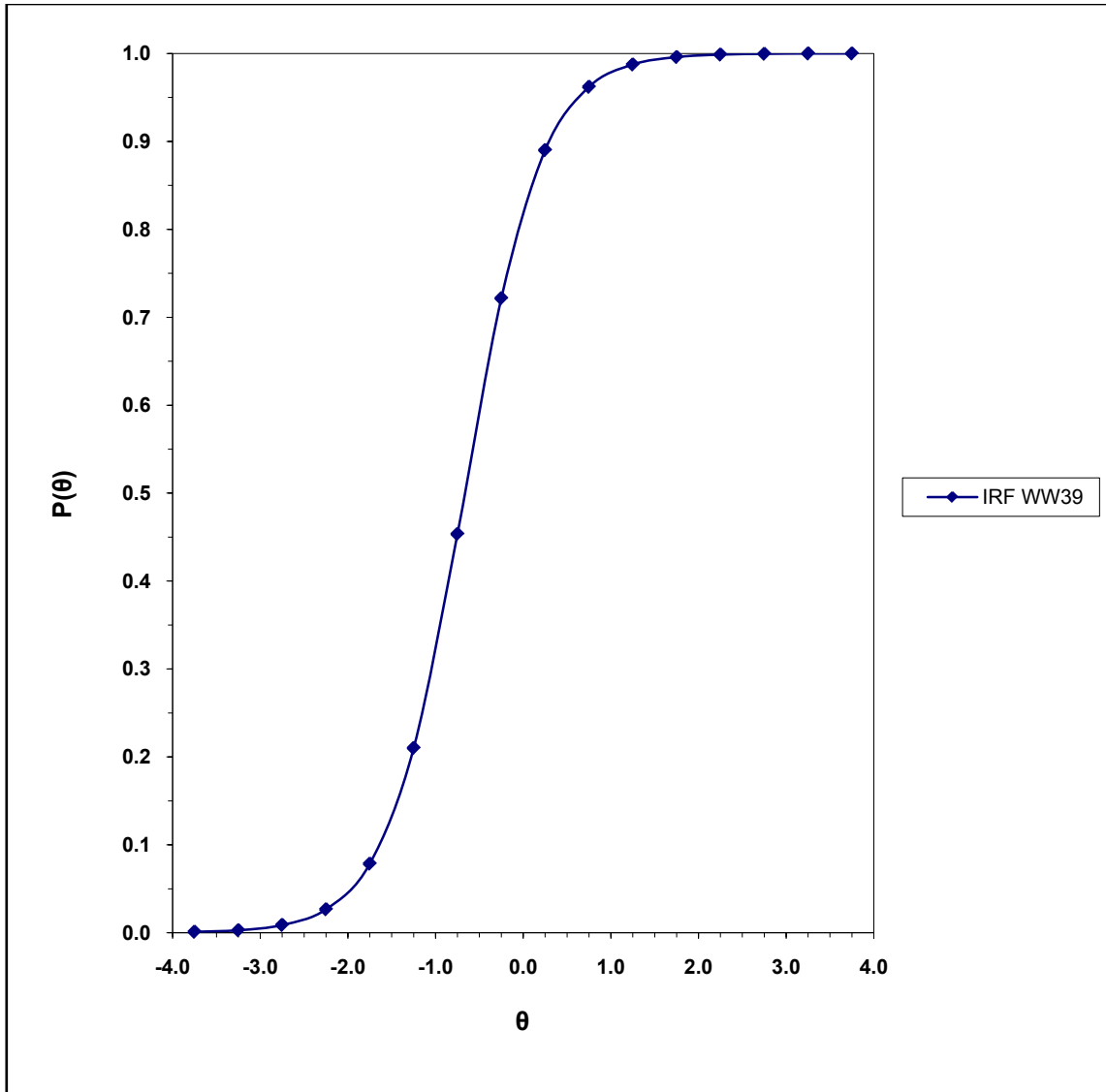


Figure 89 - Fit Plot for Item 89

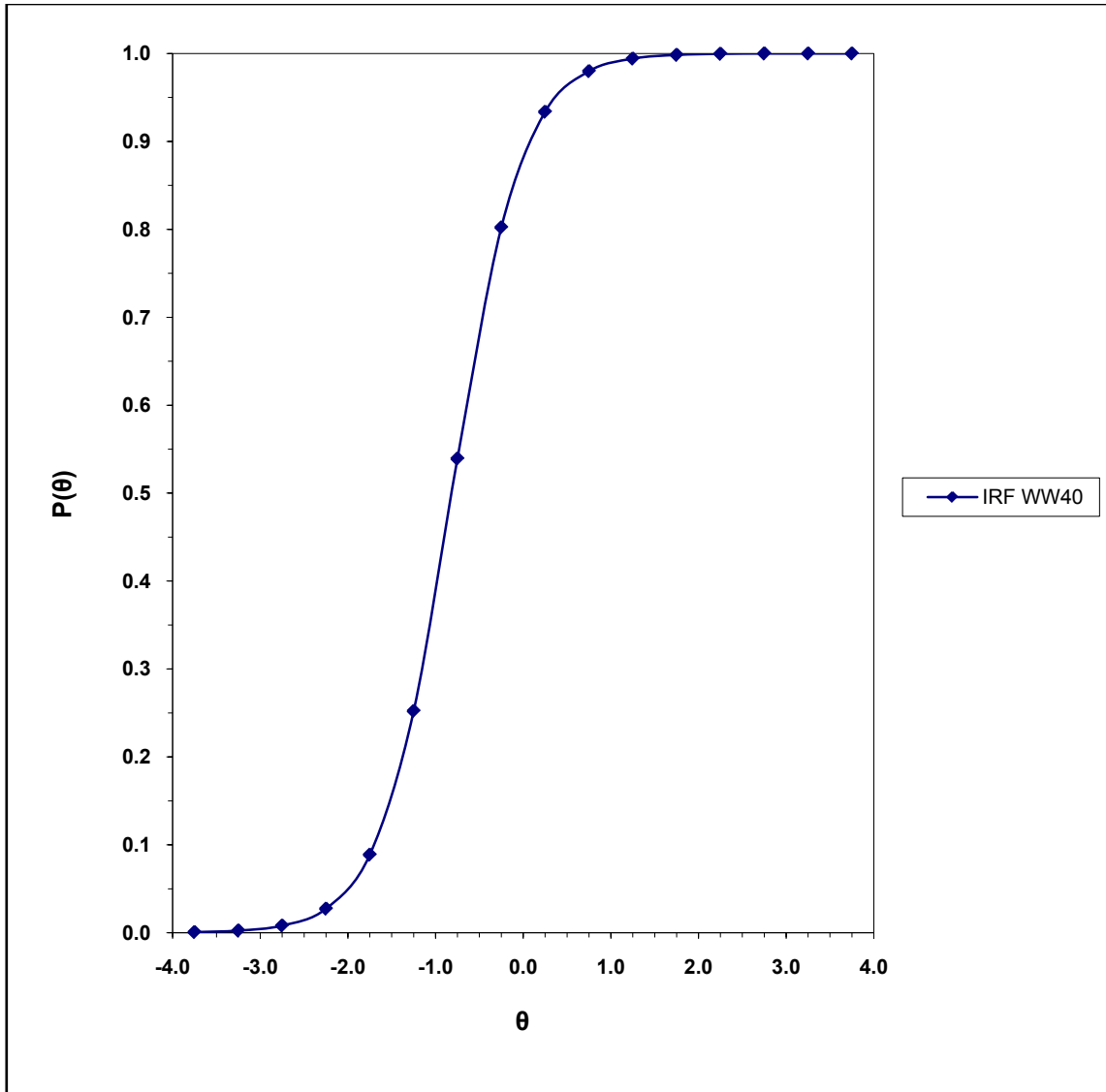


Figure 90 - Fit Plot for Item 90

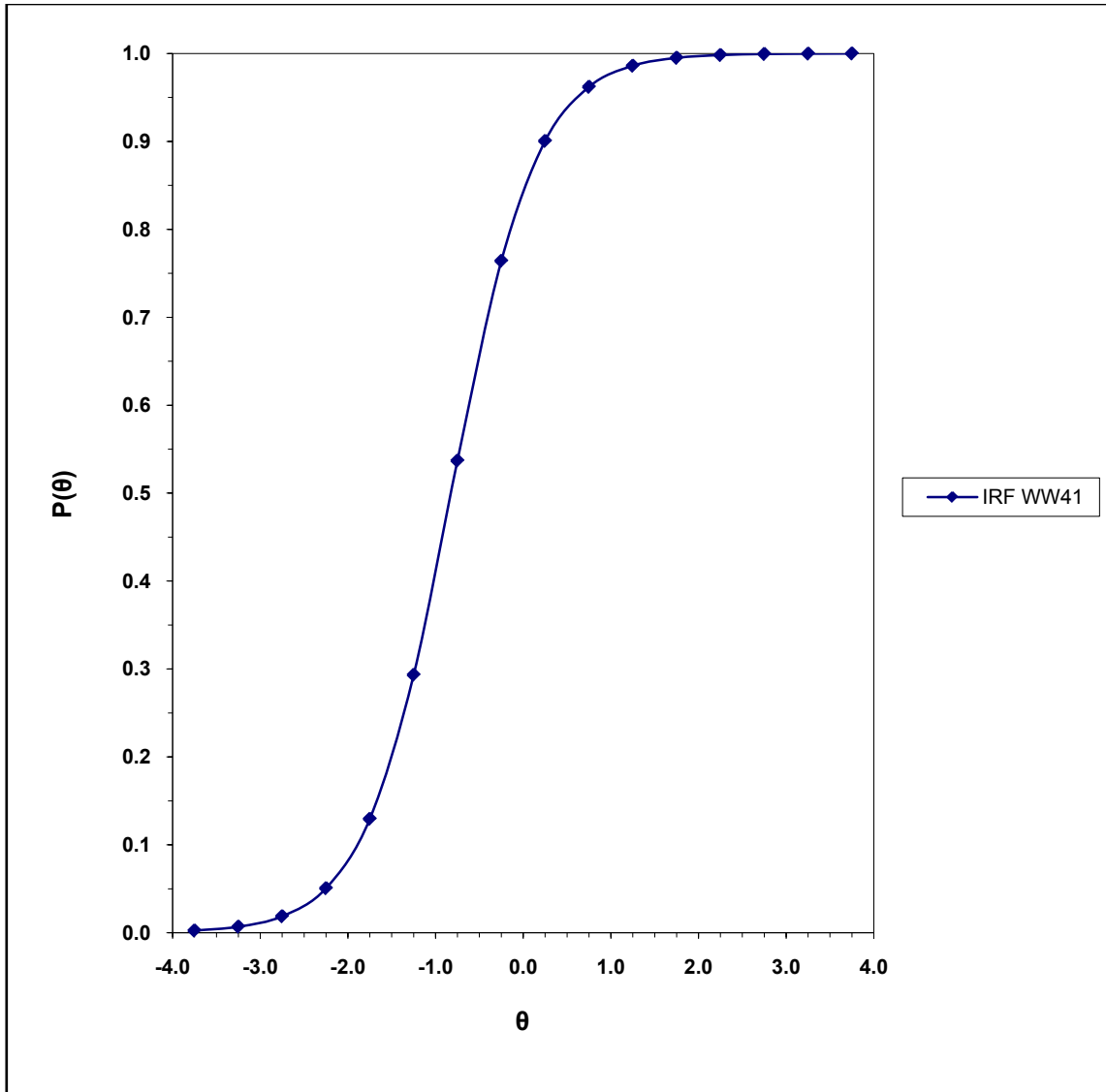


Figure 91 - Fit Plot for Item 91

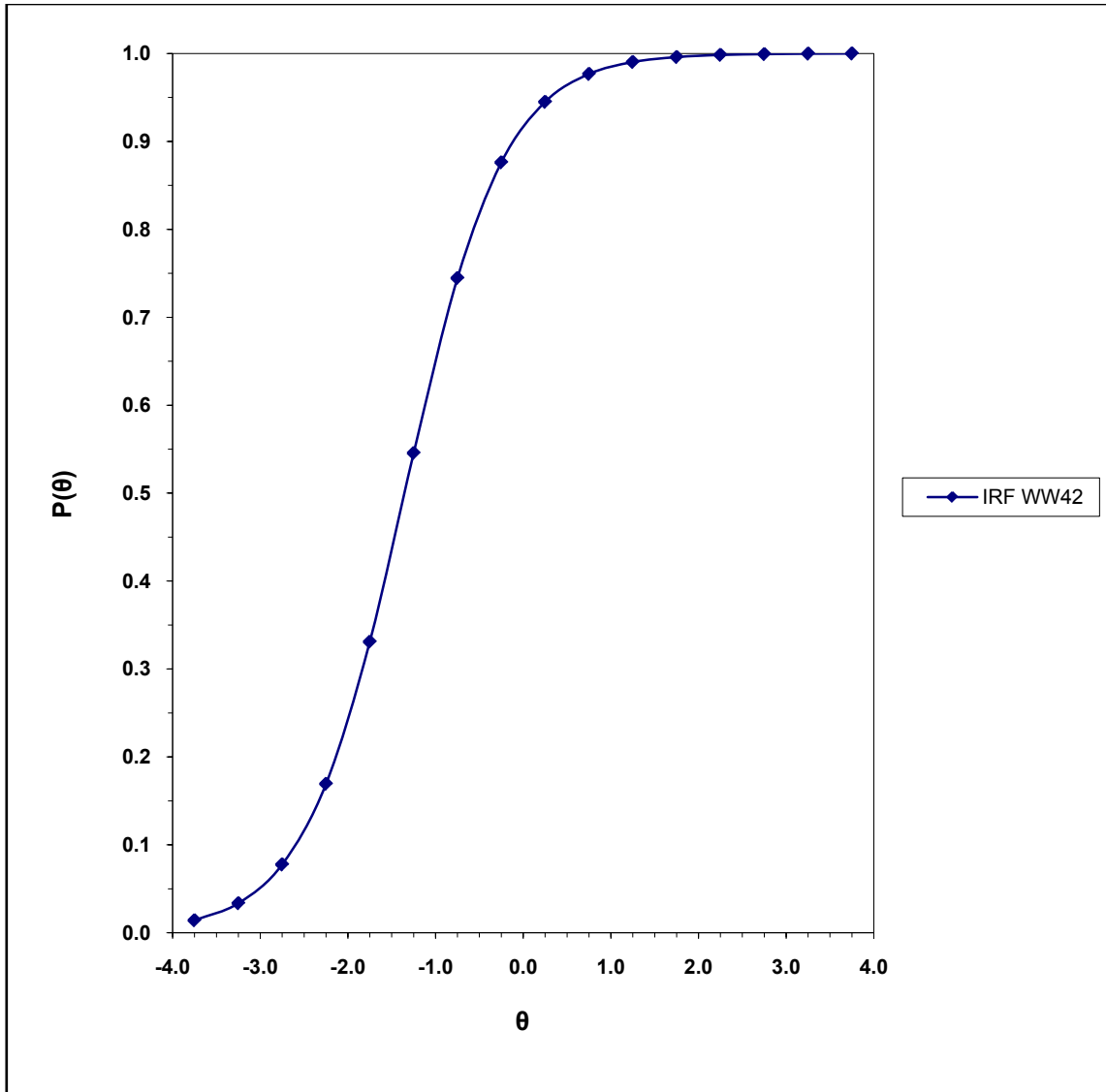


Figure 92 - Fit Plot for Item 92

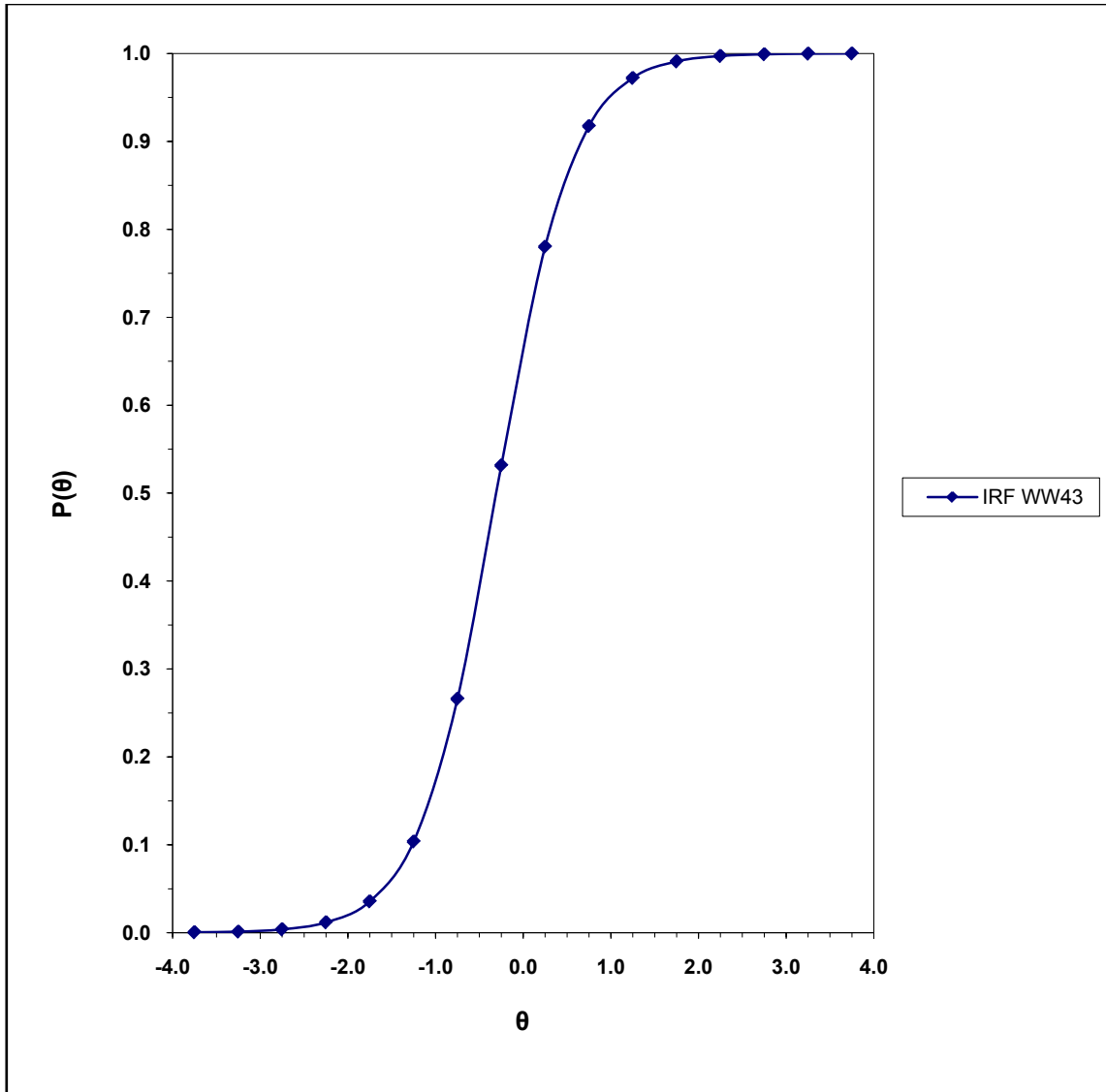


Figure 93 - Fit Plot for Item 93

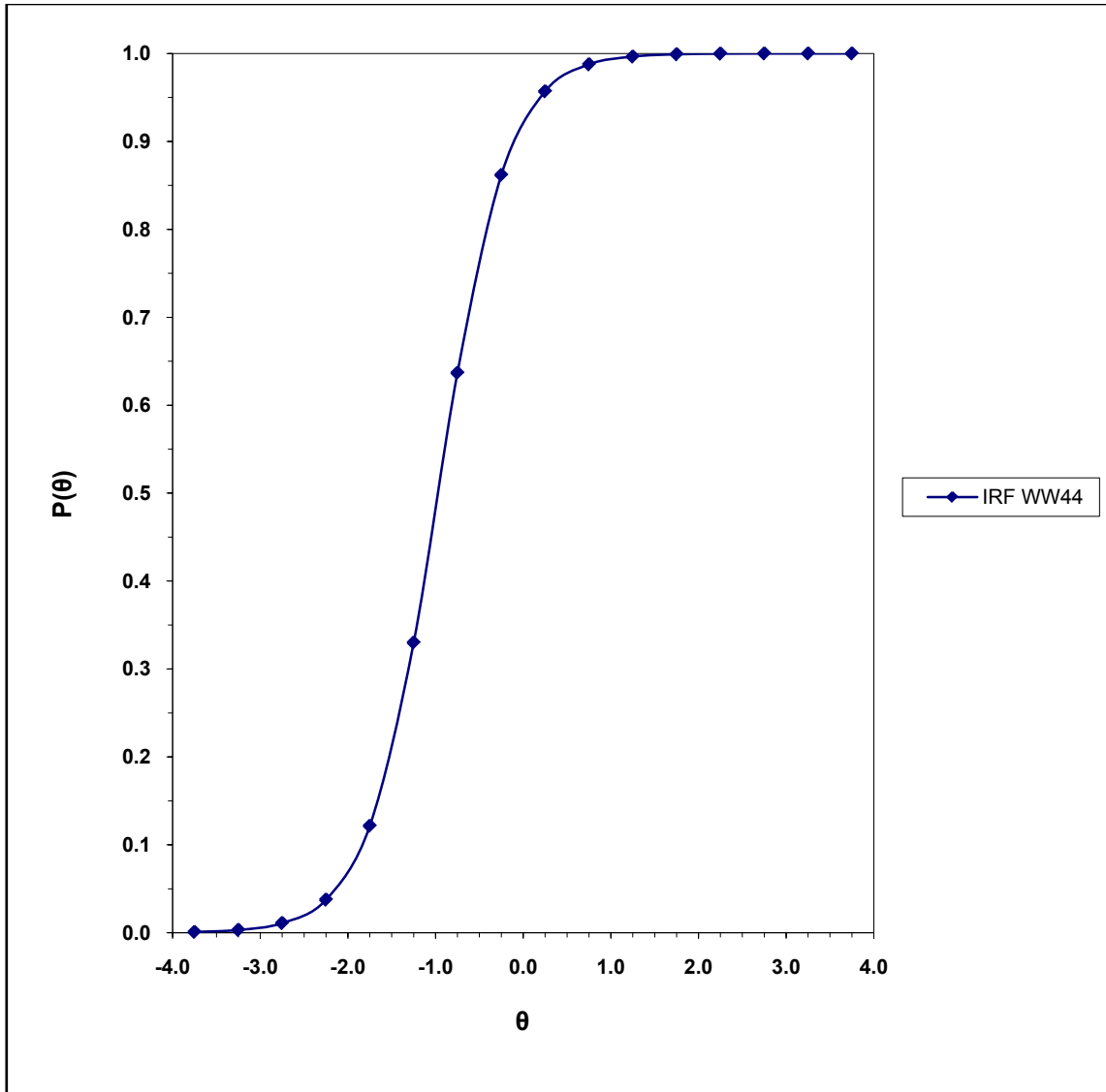


Figure 94 - Fit Plot for Item 94

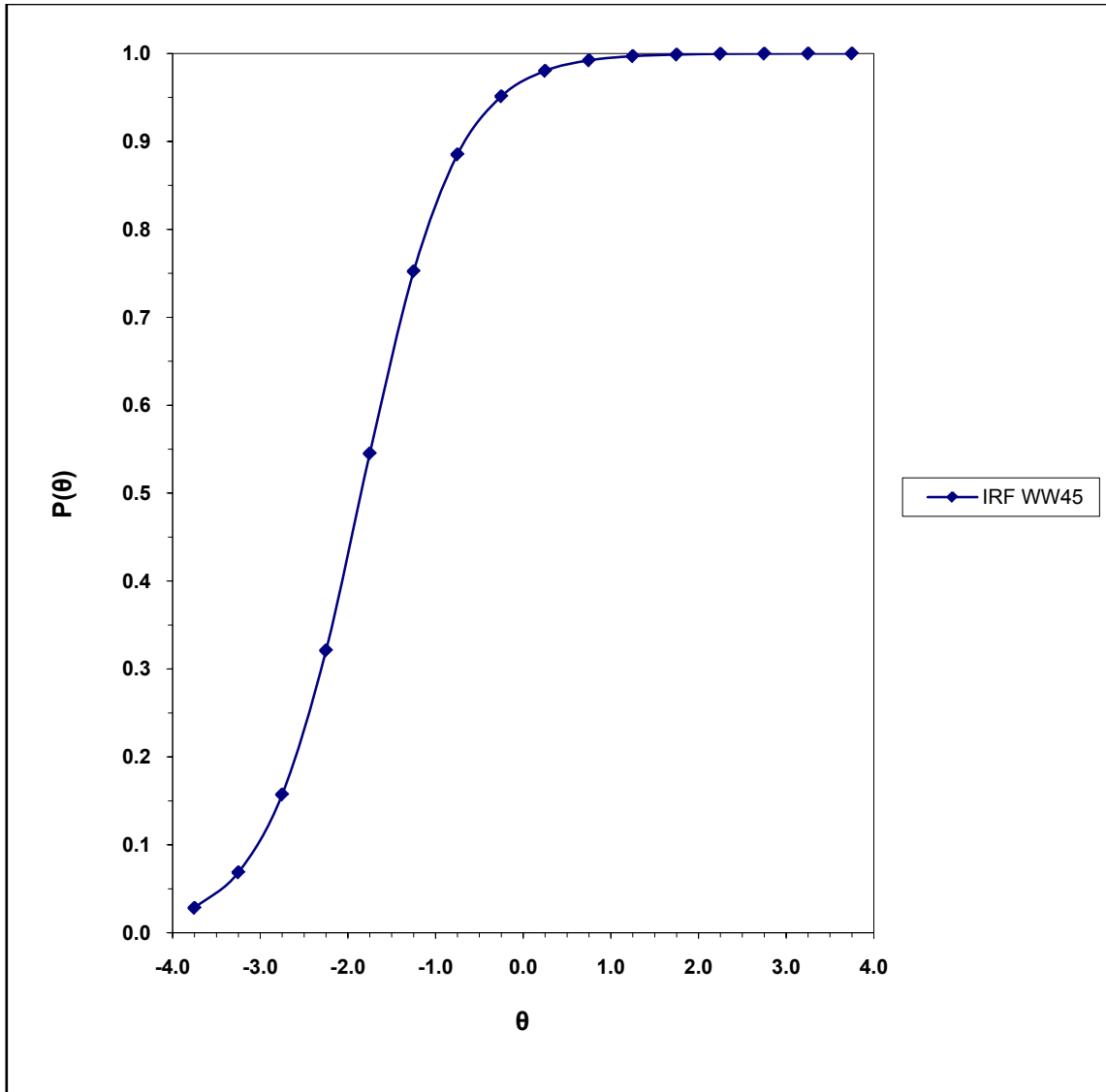


Figure 95 - Fit Plot for Item 95

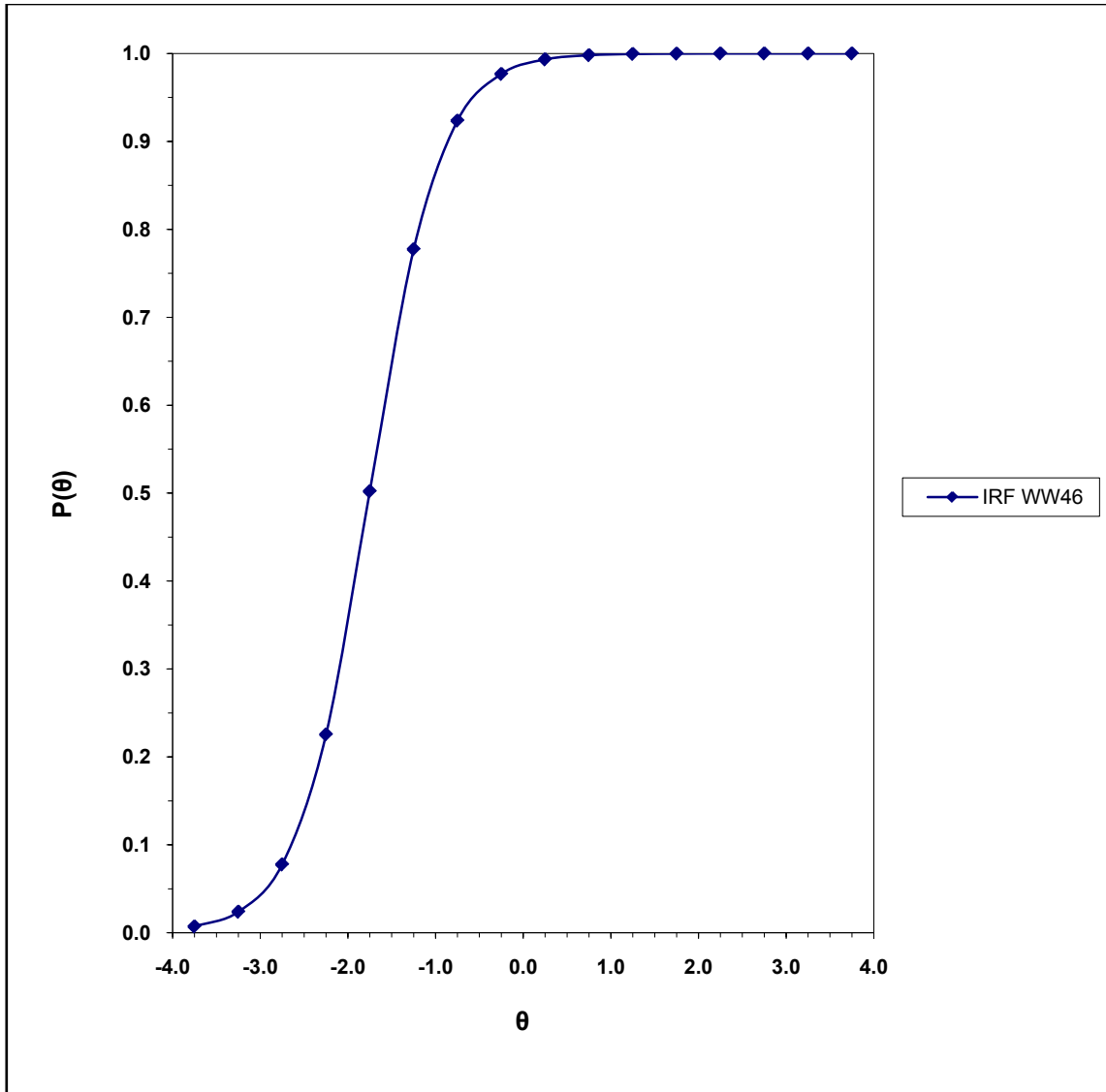


Figure 96 - Fit Plot for Item 96

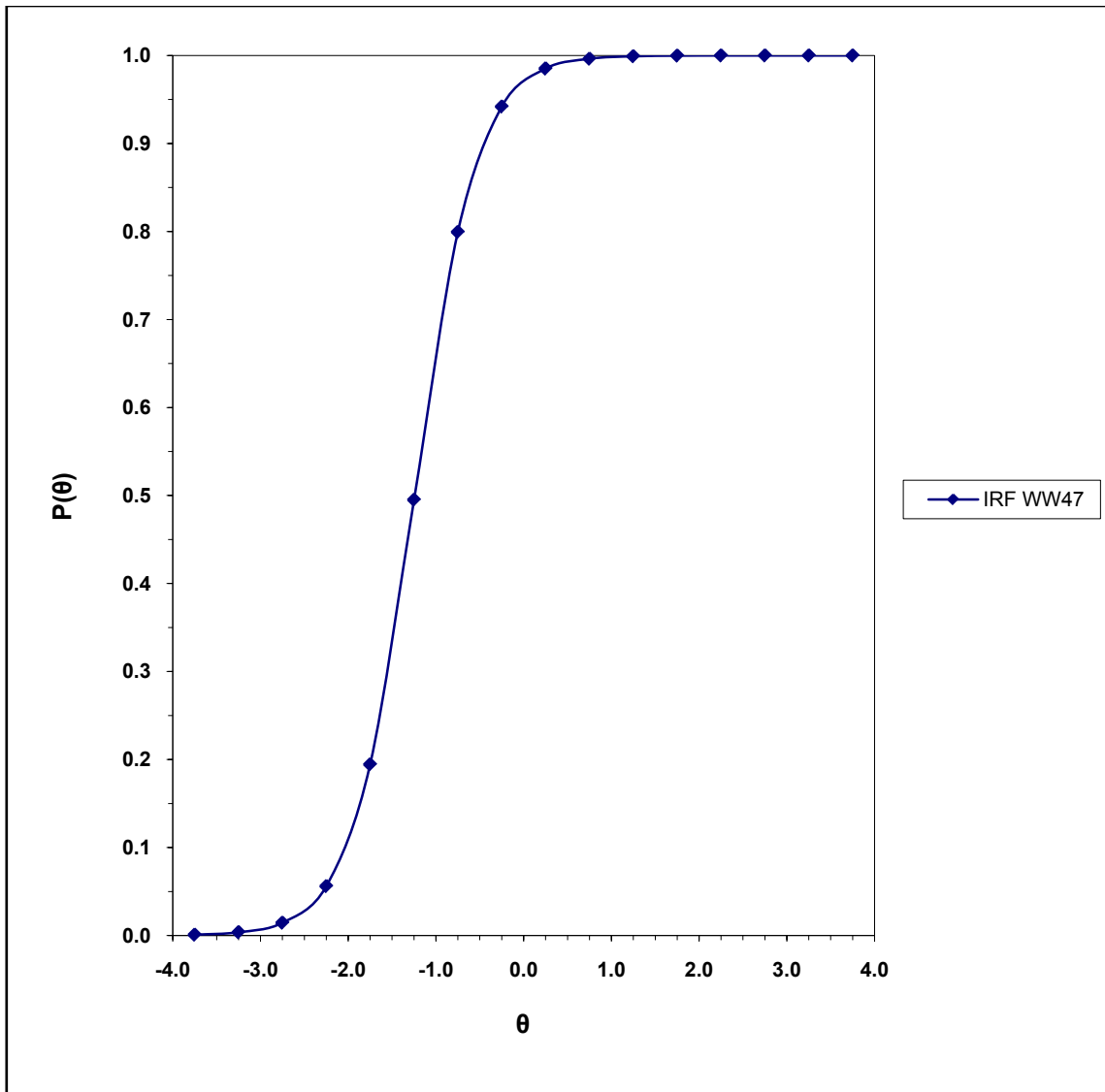


Figure 97 - Fit Plot for Item 97

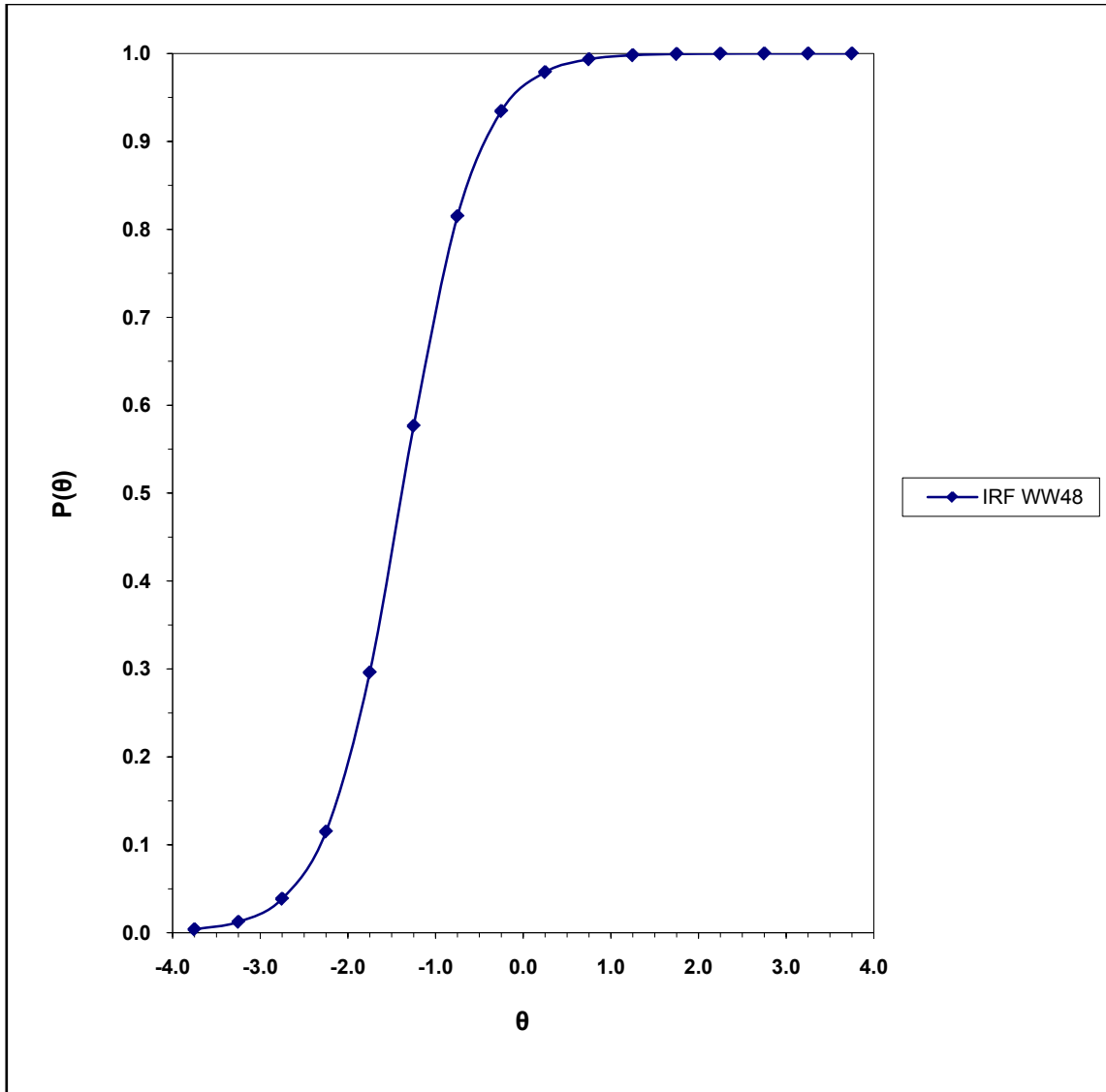


Figure 98 - Fit Plot for Item 98

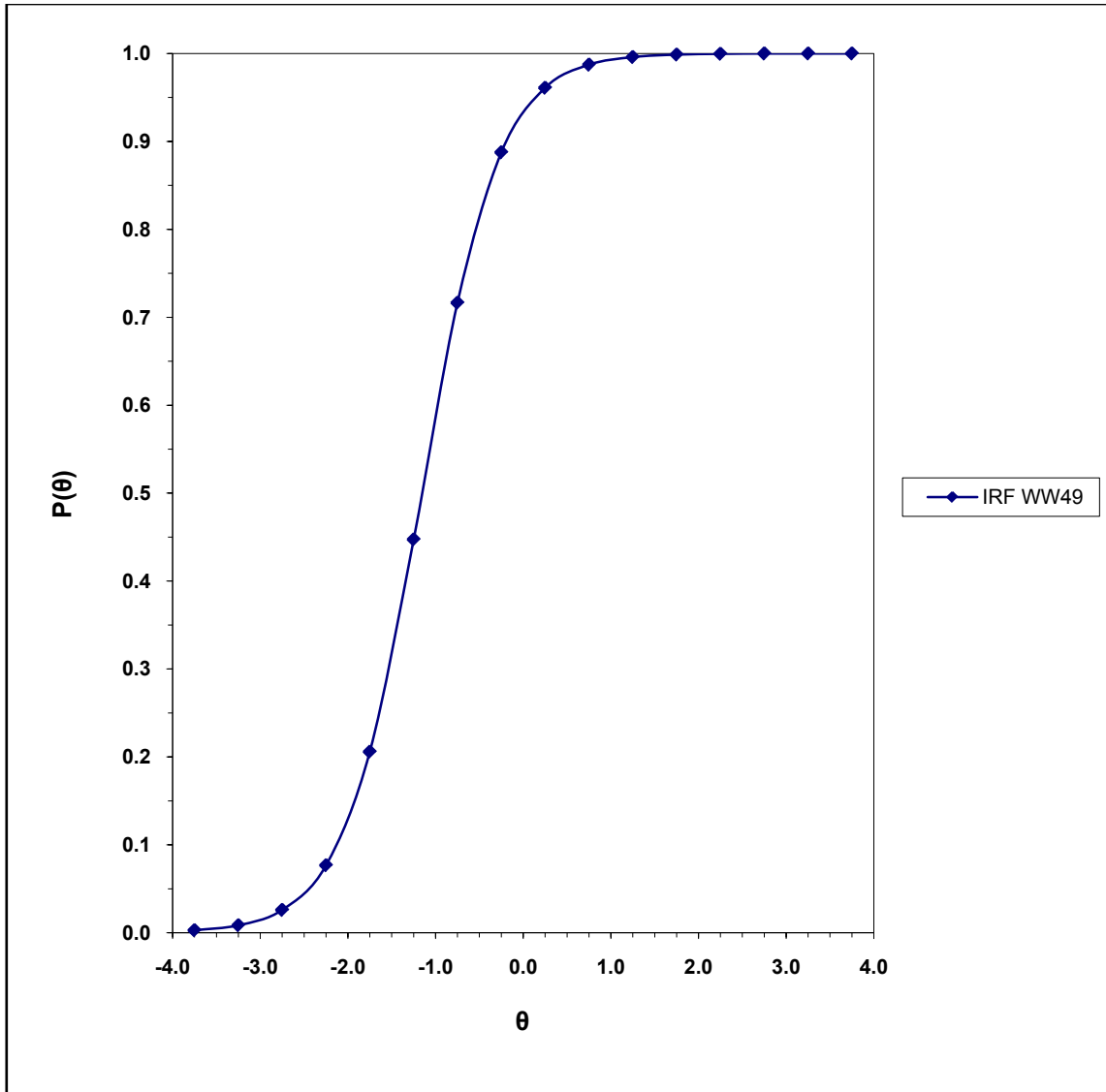


Figure 99 - Fit Plot for Item 99

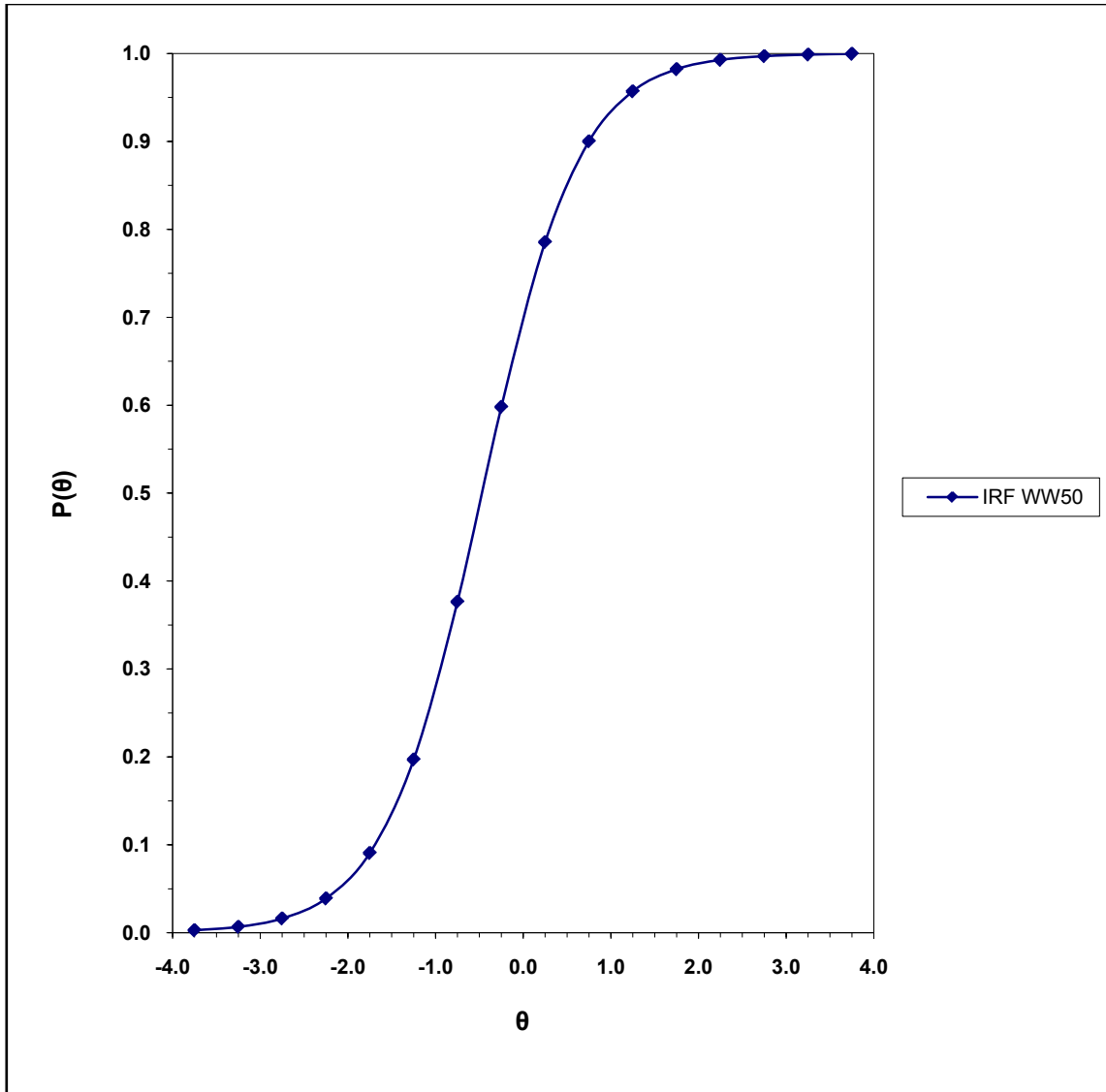


Figure 100 - Fit Plot for Item 100

From this 2PLM analysis vocabulary questions number 2, 4 and 7 appear to be inappropriate for the expected use.

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