

# How to Find the P-value from an F-Distribution Table

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The P-value is a measure of the probability that the observed data is consistent with the null hypothesis. In order to find the P-value from the F-distribution table, one must first determine the degrees of freedom for the numerator and denominator of the F-statistic. These values can be obtained from the F-test calculation. Once the degrees of freedom are determined, the corresponding value from the F-distribution table can be located. The intersection of the degrees of freedom and the F-value will provide the P-value, which is typically listed in the table as "p" or "probability." This value can then be used to determine the significance of the F-statistic and make a decision on whether to reject or fail to reject the null hypothesis.

## Here is Find the P-Value from the F-Distribution Table

The F distribution table is a table that shows the critical values of the F distribution. To use the F distribution table, you only need three values:

The numerator degrees of freedom  
The denominator degrees of freedom  
The alpha level

The F distribution is used most commonly in an Analysis of Variance, or ANOVA for short. For example, here is what the output table for an ANOVA might look like:

| Source    | SS    | df | MS   | F    | P     |
|-----------|-------|----|------|------|-------|
| Treatment | 58.8  | 2  | 29.4 | 1.74 | 0.217 |
| Error     | 202.8 | 12 | 16.9 |      |       |
| Total     | 261.6 | 14 |      |      |       |

In this example, the numerator degrees of freedom for

the F statistic is 2, the denominator degrees of freedom for the F statistic is 12, and the F statistic itself is 1.74. Suppose the alpha level we are using is 0.10. In the table above, we see that the p-value for this F statistic is 0.217. Since 0.217 is greater than the alpha level, we would conclude that this F statistic is not statistically significant.

If we instead wanted to use the , we would use the F Distribution Table for  $\alpha = 0.10$ . We would locate the critical value in the table that corresponds to a numerator degrees of freedom of 2 ( $DF1 = 2$  in the table) and a denominator degrees of freedom of 12 ( $DF2 = 12$  in the table) and find that this value is 2.8068.

|     | DF1    | $\alpha = 0.10$ |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
|-----|--------|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| DF2 | 1      | 2               | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     | 12     | 15     | 20     | 24     | 30     | 40     | 60     | 120    | Inf    |
| 1   | 39.863 | 49.5            | 53.593 | 55.833 | 57.24  | 58.204 | 58.906 | 59.439 | 59.858 | 60.195 | 60.705 | 61.22  | 61.74  | 62.002 | 62.265 | 62.529 | 62.794 | 63.061 | 63.328 |
| 2   | 8.5263 | 9               | 9.1618 | 9.2434 | 9.2926 | 9.3255 | 9.3491 | 9.3668 | 9.3805 | 9.3916 | 9.4081 | 9.4247 | 9.4413 | 9.4496 | 9.4579 | 9.4662 | 9.4746 | 9.4829 | 9.4912 |
| 3   | 5.5383 | 5.4624          | 5.3908 | 5.3426 | 5.3092 | 5.2847 | 5.2662 | 5.2517 | 5.24   | 5.2304 | 5.2156 | 5.2003 | 5.1845 | 5.1764 | 5.1681 | 5.1597 | 5.1512 | 5.1425 | 5.1337 |
| 4   | 4.5448 | 4.3246          | 4.1909 | 4.1073 | 4.0506 | 4.0098 | 3.979  | 3.9549 | 3.9357 | 3.9199 | 3.8955 | 3.8704 | 3.8443 | 3.831  | 3.8174 | 3.8036 | 3.7896 | 3.7753 | 3.7607 |
| 5   | 4.0604 | 3.7797          | 3.6195 | 3.5202 | 3.453  | 3.4045 | 3.3679 | 3.3393 | 3.3163 | 3.2974 | 3.2682 | 3.238  | 3.2067 | 3.1905 | 3.1741 | 3.1573 | 3.1402 | 3.1228 | 3.105  |
| 6   | 3.776  | 3.4633          | 3.2888 | 3.1808 | 3.1075 | 3.0546 | 3.0145 | 2.983  | 2.9577 | 2.9369 | 2.9047 | 2.8712 | 2.8363 | 2.8183 | 2.8    | 2.7812 | 2.762  | 2.7423 | 2.7222 |
| 7   | 3.5894 | 3.2574          | 3.0741 | 2.9605 | 2.8833 | 2.8274 | 2.7849 | 2.7516 | 2.7247 | 2.7025 | 2.6681 | 2.6322 | 2.5947 | 2.5753 | 2.5555 | 2.5351 | 2.5142 | 2.4928 | 2.4708 |
| 8   | 3.4579 | 3.1131          | 2.9238 | 2.8064 | 2.7265 | 2.6683 | 2.6241 | 2.5894 | 2.5612 | 2.538  | 2.502  | 2.4642 | 2.4246 | 2.4041 | 2.383  | 2.3614 | 2.3391 | 2.3162 | 2.2926 |
| 9   | 3.3603 | 3.0065          | 2.8129 | 2.6927 | 2.6106 | 2.5509 | 2.5053 | 2.4694 | 2.4403 | 2.4163 | 2.3789 | 2.3396 | 2.2983 | 2.2768 | 2.2547 | 2.232  | 2.2085 | 2.1843 | 2.1592 |
| 10  | 3.285  | 2.9245          | 2.7277 | 2.6053 | 2.5216 | 2.4606 | 2.414  | 2.3772 | 2.3473 | 2.3226 | 2.2841 | 2.2435 | 2.2007 | 2.1784 | 2.1554 | 2.1317 | 2.1072 | 2.0818 | 2.0554 |
| 11  | 3.2252 | 2.8595          | 2.6602 | 2.5362 | 2.4512 | 2.3891 | 2.3416 | 2.304  | 2.2735 | 2.2482 | 2.2087 | 2.1671 | 2.1231 | 2.1    | 2.0762 | 2.0516 | 2.0261 | 1.9997 | 1.9721 |
| 12  | 3.1766 | 2.8068          | 2.6055 | 2.4801 | 2.394  | 2.331  | 2.2828 | 2.2446 | 2.2135 | 2.1878 | 2.1474 | 2.1049 | 2.0597 | 2.036  | 2.0115 | 1.9861 | 1.9597 | 1.9323 | 1.9036 |
| 13  | 3.1362 | 2.7632          | 2.5603 | 2.4337 | 2.3467 | 2.283  | 2.2341 | 2.1954 | 2.1638 | 2.1376 | 2.0966 | 2.0532 | 2.007  | 1.9827 | 1.9576 | 1.9315 | 1.9043 | 1.8759 | 1.8462 |
| 14  | 3.1022 | 2.7265          | 2.5222 | 2.3947 | 2.3069 | 2.2426 | 2.1931 | 2.1539 | 2.122  | 2.0954 | 2.0537 | 2.0095 | 1.9625 | 1.9377 | 1.9119 | 1.8852 | 1.8572 | 1.828  | 1.7973 |
| 15  | 3.0732 | 2.6952          | 2.4898 | 2.3614 | 2.273  | 2.2081 | 2.1582 | 2.1185 | 2.0862 | 2.0593 | 2.0171 | 1.9722 | 1.9243 | 1.899  | 1.8728 | 1.8454 | 1.8168 | 1.7867 | 1.7551 |
| 16  | 3.0481 | 2.6682          | 2.4618 | 2.3327 | 2.2438 | 2.1783 | 2.128  | 2.088  | 2.0553 | 2.0282 | 1.9854 | 1.9399 | 1.8913 | 1.8656 | 1.8388 | 1.8108 | 1.7816 | 1.7508 | 1.7182 |
| 17  | 3.0262 | 2.6446          | 2.4374 | 2.3078 | 2.2183 | 2.1524 | 2.1017 | 2.0613 | 2.0284 | 2.0009 | 1.9577 | 1.9117 | 1.8624 | 1.8362 | 1.809  | 1.7805 | 1.7506 | 1.7191 | 1.6856 |
| 18  | 3.007  | 2.624           | 2.416  | 2.2858 | 2.1958 | 2.1296 | 2.0785 | 2.0379 | 2.0047 | 1.977  | 1.9333 | 1.8868 | 1.8369 | 1.8104 | 1.7827 | 1.7537 | 1.7232 | 1.691  | 1.6567 |
| 19  | 2.9899 | 2.6056          | 2.397  | 2.2663 | 2.176  | 2.1094 | 2.058  | 2.0171 | 1.9836 | 1.9557 | 1.9117 | 1.8647 | 1.8142 | 1.7873 | 1.7592 | 1.7298 | 1.6988 | 1.6659 | 1.6308 |
| 20  | 2.9747 | 2.5893          | 2.3801 | 2.2489 | 2.1582 | 2.0913 | 2.0397 | 1.9985 | 1.9649 | 1.9367 | 1.8924 | 1.8449 | 1.7938 | 1.7667 | 1.7382 | 1.7083 | 1.6768 | 1.6433 | 1.6074 |
| 21  | 2.961  | 2.5746          | 2.3649 | 2.2333 | 2.1423 | 2.0751 | 2.0233 | 1.9819 | 1.948  | 1.9197 | 1.875  | 1.8272 | 1.7756 | 1.7481 | 1.7193 | 1.689  | 1.6569 | 1.6228 | 1.5862 |
| 22  | 2.9486 | 2.5613          | 2.3512 | 2.2193 | 2.1279 | 2.0605 | 2.0084 | 1.9668 | 1.9327 | 1.9043 | 1.8593 | 1.8111 | 1.759  | 1.7312 | 1.7021 | 1.6714 | 1.6389 | 1.6042 | 1.5668 |
| 23  | 2.9374 | 2.5493          | 2.3387 | 2.2065 | 2.1149 | 2.0472 | 1.9949 | 1.9531 | 1.9189 | 1.8903 | 1.845  | 1.7964 | 1.7439 | 1.7159 | 1.6864 | 1.6554 | 1.6224 | 1.5871 | 1.549  |
| 24  | 2.9271 | 2.5383          | 2.3274 | 2.1949 | 2.103  | 2.0351 | 1.9826 | 1.9407 | 1.9063 | 1.8775 | 1.8319 | 1.7831 | 1.7302 | 1.7019 | 1.6721 | 1.6407 | 1.6073 | 1.5715 | 1.5327 |
| 25  | 2.9177 | 2.5283          | 2.317  | 2.1842 | 2.0922 | 2.0241 | 1.9714 | 1.9293 | 1.8947 | 1.8658 | 1.82   | 1.7708 | 1.7175 | 1.689  | 1.659  | 1.6272 | 1.5934 | 1.557  | 1.5176 |
| 26  | 2.9091 | 2.5191          | 2.3075 | 2.1745 | 2.0822 | 2.0139 | 1.961  | 1.9188 | 1.8841 | 1.855  | 1.809  | 1.7596 | 1.7059 | 1.6771 | 1.6468 | 1.6147 | 1.5805 | 1.5437 | 1.5036 |
| 27  | 2.9012 | 2.5106          | 2.2987 | 2.1655 | 2.073  | 2.0045 | 1.9515 | 1.9091 | 1.8743 | 1.8451 | 1.7989 | 1.7492 | 1.6951 | 1.6662 | 1.6356 | 1.6032 | 1.5686 | 1.5313 | 1.4906 |
| 28  | 2.8939 | 2.5028          | 2.2906 | 2.1571 | 2.0645 | 1.9959 | 1.9427 | 1.9001 | 1.8652 | 1.8359 | 1.7895 | 1.7395 | 1.6852 | 1.656  | 1.6252 | 1.5925 | 1.5575 | 1.5198 | 1.4784 |
| 29  | 2.887  | 2.4955          | 2.2831 | 2.1494 | 2.0566 | 1.9878 | 1.9345 | 1.8918 | 1.8568 | 1.8274 | 1.7808 | 1.7306 | 1.6759 | 1.6466 | 1.6155 | 1.5825 | 1.5472 | 1.509  | 1.467  |
| 30  | 2.8807 | 2.4887          | 2.2761 | 2.1422 | 2.0493 | 1.9803 | 1.9269 | 1.8841 | 1.849  | 1.8195 | 1.7727 | 1.7223 | 1.6673 | 1.6377 | 1.6065 | 1.5732 | 1.5376 | 1.4989 | 1.4564 |
| 40  | 2.8354 | 2.4404          | 2.2261 | 2.091  | 1.9968 | 1.9269 | 1.8725 | 1.8289 | 1.7929 | 1.7627 | 1.7146 | 1.6624 | 1.6052 | 1.5741 | 1.5411 | 1.5056 | 1.4672 | 1.4248 | 1.3769 |
| 60  | 2.7911 | 2.3933          | 2.1774 | 2.041  | 1.9457 | 1.8747 | 1.8194 | 1.7748 | 1.738  | 1.707  | 1.6574 | 1.6034 | 1.5435 | 1.5107 | 1.4755 | 1.4373 | 1.3952 | 1.3476 | 1.2915 |
| 120 | 2.7478 | 2.3473          | 2.13   | 1.9923 | 1.8959 | 1.8238 | 1.7675 | 1.722  | 1.6843 | 1.6524 | 1.6012 | 1.545  | 1.4821 | 1.4472 | 1.4094 | 1.3676 | 1.3203 | 1.2646 | 1.1926 |
| Inf | 2.7055 | 2.3026          | 2.0838 | 1.9449 | 1.8473 | 1.7741 | 1.7167 | 1.6702 | 1.6315 | 1.5987 | 1.5458 | 1.4871 | 1.4206 | 1.3832 | 1.3419 | 1.2951 | 1.24   | 1.1686 | 1      |

Since our F statistic of 1.74 from the ANOVA table is not greater than the F critical value of 2.8068 from the F Distribution table, we would conclude that the F statistic is not significant at the alpha level of 0.10.

The F Distribution Table Provides Critical Values, Not P-Values

Notice in the example above that the F Distribution Table simply gives us an F critical value to compare our F statistic to. The F Distribution Table does not directly give us a p-value.

If you have an F statistic with a numerator degrees of freedom and denominator degrees of freedom and you

would like to find the p-value for it, then you would need to use an .

For example, suppose we knew that our F statistic was 1.74, the numerator degrees of freedom was 2, and the denominator degrees of freedom was 12 and we wanted to find the p-value for this F statistic. In this case, we would enter the following numbers into the F Distribution Calculator:

*Note: Leave the last box blank. The calculator will automatically find this value for you.*

### F Distribution Calculator

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Degrees of freedom 1 (numerator)

Degrees of freedom 2 (denominator)

F-value

Cumulative probability:  $P(F \leq \text{F-value})$

**This tells us that the cumulative probability is 0.78300. This is the area to the left of the F statistic in the F distribution. Typically we're interested in the area to the right of the F statistic, so in this case the p-value would be  $1 - 0.78300 = 0.217$ .**

## When to Use the F Distribution Table

If you are interested in finding the F critical value for a given numerator degrees of freedom, denominator degrees of freedom, and alpha level, then you should use the F distribution table.

Instead, if you have a given F statistic (from an ANOVA or some other statistical test) with a given numerator degrees of freedom and denominator degrees of freedom and you simply want to know the p-value of that F statistic, then you would need to use an to do so.