# How to Use the F-Distribution Table to Find Critical Values

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## Understanding the Foundational Role of the F-Distribution Table

The **F-Distribution Table** serves as an indispensable analytical instrument within the realm of **statistics**, providing researchers with the necessary **critical values** required to interpret the **F-distribution**. This specific distribution is a continuous probability distribution that arises frequently as the null distribution of a test statistic, most notably in the **analysis of variance** (ANOVA). By offering a standardized set of values, the table allows statisticians to determine whether the observed variance between different groups of data is likely due to chance or reflects a genuine underlying effect. Without this structured reference, the process of conducting complex hypothesis testing would be significantly more labor-intensive and prone to calculation errors.

At its core, the **F-Distribution Table** facilitates the comparison of two different estimates of **variance**. These tables are meticulously organized to correspond with various levels of **statistical significance**, commonly referred to as **alpha levels**. This categorization ensures that researchers can select a threshold for error that aligns with the rigor of their specific study. Because the F-distribution is non-symmetric and depends heavily on the shape determined by its **degrees of freedom**, the table acts as a comprehensive map for navigating the probabilities associated with different experimental outcomes. It is a vital component for anyone seeking to perform robust statistical inferences across multiple data sets.

Furthermore, the utility of the **F-Distribution Table** extends to both one-tailed and two-tailed tests, providing a versatile framework for diverse research methodologies. In modern data science and academic research, while software often automates these calculations, understanding how to read and interpret the table remains a fundamental skill. It provides the mathematical context behind the **p-value**, helping researchers visualize the rejection region for a **null hypothesis**. By mastering this tool, one gains a deeper insight into the mechanics of **regression analysis** and other comparative statistical models.



## Key Parameters and Components of the F-Distribution Table

To effectively utilize the **F-distribution table**, one must first understand the three primary input values that determine the specific **critical value** for a given test. These parameters are essential for locating the correct intersection within the table's grid. The first parameter is the **numerator degrees of freedom**, which typically relates to the number of groups or variables being compared. The second is the **denominator degrees of freedom**, which generally accounts for the total number of observations minus the number of groups. Finally, the **alpha level** (or significance level) must be chosen to define the probability of committing a Type I error.

The standard layout of an **F-distribution table** features the numerator degrees of freedom (often denoted as *DF1*) across the horizontal header at the top. Conversely, the denominator degrees of freedom (labeled as *DF2*) are listed vertically along the left-hand margin. Each cell in the table represents the **critical value** for a specific combination of these two degrees of freedom at a predefined **alpha level**. Common alpha levels found in these tables include 0.10, 0.05, and 0.01, representing 10%, 5%, and 1% significance thresholds, respectively. Selecting the appropriate table is a prerequisite for ensuring that the **statistical significance** of the results is assessed correctly.

As illustrated in the following visual aid, the structure of the table allows for rapid cross-referencing. For instance, an **alpha level** of 0.10 is frequently used in exploratory research where a higher tolerance for potential error is acceptable. Users should carefully identify the *DF1* and *DF2* values derived from their specific **F-distribution** calculation before attempting to locate the critical threshold. This systematic approach ensures that the interpretation of the **F-test** is grounded in accurate mathematical theory and standard statistical practice.

*Users may interact with the image below to view the detailed values for the 0.10 significance level.*

| | DF1 | α = 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 |

## The Statistical Logic Behind Critical Values and Hypothesis Testing

The values contained within the **F-distribution table** are utilized primarily to evaluate the **null hypothesis** in various experimental designs. When a researcher performs an **F-test**, they calculate an **F-statistic** based on their sample data. This calculated value is then compared against the **critical value** found in the table. If the calculated F-statistic is substantially larger than the critical value, it indicates that the observed differences in the data are unlikely to have occurred by chance. Consequently, the researcher may reject the **null hypothesis**, concluding that the results are indeed statistically significant.

This process is central to the concept of **statistical inference**, where conclusions about a population are drawn from a limited sample. The **F-distribution** is always positive and skewed to the right, meaning that larger F-statistics move further into the "tail" of the distribution. The **critical value** essentially marks the boundary of the rejection region. By using the **F-distribution table**, researchers can precisely define this boundary based on their specific **degrees of freedom** and desired **alpha level**, ensuring that their conclusions are supported by rigorous mathematical evidence.

There are three primary scenarios where the **F-distribution table** is most frequently applied in academic and professional research. These include **regression analysis**, where the overall model fit is tested; **ANOVA**, where means between multiple groups are compared; and tests for the equality of **variances** between two distinct populations. Each of these applications relies on the same fundamental logic of comparing a calculated ratio to a theoretical threshold. Understanding these scenarios is vital for applying the correct statistical methodology to any given data set.



## Applying the F-Distribution Table in Regression Analysis

In the context of **regression analysis**, the F-test is employed to determine whether a **linear regression** model as a whole is statistically significant. For example, consider a study examining how **hours studied** and **prep exams taken** predict a student's **final exam score**. The **F-test** in this scenario evaluates whether the combination of these independent variables significantly predicts the dependent variable better than a model with no predictors. This is often summarized in a regression output table, which includes values for the Sum of Squares (SS), **degrees of freedom** (df), and Mean Squares (MS).

| Source | SS | df | MS | F | P |
|---|---|---|---|---|---|
| Regression | 546.53 | 2 | 273.26 | 5.09 | 0.033 |
| Residual | 483.13 | 9 | 53.68 | | |
| Total | 1029.66 | 11 | | | |

To calculate the F-statistic, the Mean Square for Regression is divided by the Mean Square for Residuals. In our specific example, the calculation is **273.26 / 53.68 = 5.09**. This F-statistic must then be compared to a **critical value** from the **F-distribution table**. With a numerator df of 2 and a denominator df of 9, and choosing an **alpha level** of 0.05, we look at the corresponding table to find the threshold. The critical value for these parameters is **4.2565**.

| | DF1 | α = 0.05 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DF2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 15 | 20 | 24 | 30 | 40 | 60 | 120 | Inf |
| 1 | 161.45 | 199.5 | 215.71 | 224.58 | 230.16 | 233.99 | 236.77 | 238.88 | 240.54 | 241.88 | 243.91 | 245.95 | 248.01 | 249.05 | 250.1 | 251.14 | 252.2 | 253.25 | 254.31 |
| 2 | 18.513 | 19 | 19.164 | 19.247 | 19.296 | 19.33 | 19.353 | 19.371 | 19.385 | 19.396 | 19.413 | 19.429 | 19.446 | 19.454 | 19.462 | 19.471 | 19.479 | 19.487 | 19.496 |
| 3 | 10.128 | 9.5521 | 9.2766 | 9.1172 | 9.0135 | 8.9406 | 8.8867 | 8.8452 | 8.8123 | 8.7855 | 8.7446 | 8.7029 | 8.6602 | 8.6385 | 8.6166 | 8.5944 | 8.572 | 8.5494 | 8.5264 |
| 4 | 7.7086 | 6.9443 | 6.5914 | 6.3882 | 6.2561 | 6.1631 | 6.0942 | 6.041 | 5.9988 | 5.9644 | 5.9117 | 5.8578 | 5.8025 | 5.7744 | 5.7459 | 5.717 | 5.6877 | 5.6581 | 5.6281 |
| 5 | 6.6079 | 5.7861 | 5.4095 | 5.1922 | 5.0503 | 4.9503 | 4.8759 | 4.8183 | 4.7725 | 4.7351 | 4.6777 | 4.6188 | 4.5581 | 4.5272 | 4.4957 | 4.4638 | 4.4314 | 4.3985 | 4.365 |
| 6 | 5.9874 | 5.1433 | 4.7571 | 4.5337 | 4.3874 | 4.2839 | 4.2067 | 4.1468 | 4.099 | 4.06 | 3.9999 | 3.9381 | 3.8742 | 3.8415 | 3.8082 | 3.7743 | 3.7398 | 3.7047 | 3.6689 |
| 7 | 5.5914 | 4.7374 | 4.3468 | 4.1203 | 3.9715 | 3.866 | 3.787 | 3.7257 | 3.6767 | 3.6365 | 3.5747 | 3.5107 | 3.4445 | 3.4105 | 3.3758 | 3.3404 | 3.3043 | 3.2674 | 3.2298 |
| 8 | 5.3177 | 4.459 | 4.0662 | 3.8379 | 3.6875 | 3.5806 | 3.5005 | 3.4381 | 3.3881 | 3.3472 | 3.2839 | 3.2184 | 3.1503 | 3.1152 | 3.0794 | 3.0428 | 3.0053 | 2.9669 | 2.9276 |
| 9 | 5.1174 | 4.2565 | 3.8625 | 3.6331 | 3.4817 | 3.3738 | 3.2927 | 3.2296 | 3.1789 | 3.1373 | 3.0729 | 3.0061 | 2.9365 | 2.9005 | 2.8637 | 2.8259 | 2.7872 | 2.7475 | 2.7067 |
| 10 | 4.9646 | 4.1028 | 3.7083 | 3.478 | 3.3258 | 3.2172 | 3.1355 | 3.0717 | 3.0204 | 2.9782 | 2.913 | 2.845 | 2.774 | 2.7372 | 2.6996 | 2.6609 | 2.6211 | 2.5801 | 2.5379 |
| 11 | 4.8443 | 3.9823 | 3.5874 | 3.3567 | 3.2039 | 3.0946 | 3.0123 | 2.948 | 2.8962 | 2.8536 | 2.7876 | 2.7186 | 2.6464 | 2.609 | 2.5705 | 2.5309 | 2.4901 | 2.448 | 2.4045 |
| 12 | 4.7472 | 3.8853 | 3.4903 | 3.2592 | 3.1059 | 2.9961 | 2.9134 | 2.8486 | 2.7964 | 2.7534 | 2.6866 | 2.6169 | 2.5436 | 2.5055 | 2.4663 | 2.4259 | 2.3842 | 2.341 | 2.2962 |
| 13 | 4.6672 | 3.8056 | 3.4105 | 3.1791 | 3.0254 | 2.9153 | 2.8321 | 2.7669 | 2.7144 | 2.671 | 2.6037 | 2.5331 | 2.4589 | 2.4202 | 2.3803 | 2.3392 | 2.2966 | 2.2524 | 2.2064 |
| 14 | 4.6001 | 3.7389 | 3.3439 | 3.1122 | 2.9582 | 2.8477 | 2.7642 | 2.6987 | 2.6458 | 2.6022 | 2.5342 | 2.463 | 2.3879 | 2.3487 | 2.3082 | 2.2664 | 2.2229 | 2.1778 | 2.1307 |
| 15 | 4.5431 | 3.6823 | 3.2874 | 3.0556 | 2.9013 | 2.7905 | 2.7066 | 2.6408 | 2.5876 | 2.5437 | 2.4753 | 2.4034 | 2.3275 | 2.2878 | 2.2468 | 2.2043 | 2.1601 | 2.1141 | 2.0658 |
| 16 | 4.494 | 3.6337 | 3.2389 | 3.0069 | 2.8524 | 2.7413 | 2.6572 | 2.5911 | 2.5377 | 2.4935 | 2.4247 | 2.3522 | 2.2756 | 2.2354 | 2.1938 | 2.1507 | 2.1058 | 2.0589 | 2.0096 |
| 17 | 4.4513 | 3.5915 | 3.1968 | 2.9647 | 2.81 | 2.6987 | 2.6143 | 2.548 | 2.4943 | 2.4499 | 2.3807 | 2.3077 | 2.2304 | 2.1898 | 2.1477 | 2.104 | 2.0584 | 2.0107 | 1.9604 |
| 18 | 4.4139 | 3.5546 | 3.1599 | 2.9277 | 2.7729 | 2.6613 | 2.5767 | 2.5102 | 2.4563 | 2.4117 | 2.3421 | 2.2686 | 2.1906 | 2.1497 | 2.1071 | 2.0629 | 2.0166 | 1.9681 | 1.9168 |
| 19 | 4.3807 | 3.5219 | 3.1274 | 2.8951 | 2.7401 | 2.6283 | 2.5435 | 2.4768 | 2.4227 | 2.3779 | 2.308 | 2.2341 | 2.1555 | 2.1141 | 2.0712 | 2.0264 | 1.9795 | 1.9302 | 1.878 |
| 20 | 4.3512 | 3.4928 | 3.0984 | 2.8661 | 2.7109 | 2.599 | 2.514 | 2.4471 | 2.3928 | 2.3479 | 2.2776 | 2.2033 | 2.1242 | 2.0825 | 2.0391 | 1.9938 | 1.9464 | 1.8963 | 1.8432 |
| 21 | 4.3248 | 3.4668 | 3.0725 | 2.8401 | 2.6848 | 2.5727 | 2.4876 | 2.4205 | 2.366 | 2.321 | 2.2504 | 2.1757 | 2.096 | 2.054 | 2.0102 | 1.9645 | 1.9165 | 1.8657 | 1.8117 |
| 22 | 4.3009 | 3.4434 | 3.0491 | 2.8167 | 2.6613 | 2.5491 | 2.4638 | 2.3965 | 2.3419 | 2.2967 | 2.2258 | 2.1508 | 2.0707 | 2.0283 | 1.9842 | 1.938 | 1.8894 | 1.838 | 1.7831 |
| 23 | 4.2793 | 3.4221 | 3.028 | 2.7955 | 2.64 | 2.5277 | 2.4422 | 2.3748 | 2.3201 | 2.2747 | 2.2036 | 2.1282 | 2.0476 | 2.005 | 1.9605 | 1.9139 | 1.8648 | 1.8128 | 1.757 |
| 24 | 4.2597 | 3.4028 | 3.0088 | 2.7763 | 2.6207 | 2.5082 | 2.4226 | 2.3551 | 2.3002 | 2.2547 | 2.1834 | 2.1077 | 2.0267 | 1.9838 | 1.939 | 1.892 | 1.8424 | 1.7896 | 1.733 |
| 25 | 4.2417 | 3.3852 | 2.9912 | 2.7587 | 2.603 | 2.4904 | 2.4047 | 2.3371 | 2.2821 | 2.2365 | 2.1649 | 2.0889 | 2.0075 | 1.9643 | 1.9192 | 1.8718 | 1.8217 | 1.7684 | 1.711 |
| 26 | 4.2252 | 3.369 | 2.9752 | 2.7426 | 2.5868 | 2.4741 | 2.3883 | 2.3205 | 2.2655 | 2.2197 | 2.1479 | 2.0716 | 1.9898 | 1.9464 | 1.901 | 1.8533 | 1.8027 | 1.7488 | 1.6906 |
| 27 | 4.21 | 3.3541 | 2.9604 | 2.7278 | 2.5719 | 2.4591 | 2.3732 | 2.3053 | 2.2501 | 2.2043 | 2.1323 | 2.0558 | 1.9736 | 1.9299 | 1.8842 | 1.8361 | 1.7851 | 1.7306 | 1.6717 |
| 28 | 4.196 | 3.3404 | 2.9467 | 2.7141 | 2.5581 | 2.4453 | 2.3593 | 2.2913 | 2.236 | 2.19 | 2.1179 | 2.0411 | 1.9586 | 1.9147 | 1.8687 | 1.8203 | 1.7689 | 1.7138 | 1.6541 |
| 29 | 4.183 | 3.3277 | 2.934 | 2.7014 | 2.5454 | 2.4324 | 2.3463 | 2.2783 | 2.2229 | 2.1768 | 2.1045 | 2.0275 | 1.9446 | 1.9005 | 1.8543 | 1.8055 | 1.7537 | 1.6981 | 1.6376 |
| 30 | 4.1709 | 3.3158 | 2.9223 | 2.6896 | 2.5336 | 2.4205 | 2.3343 | 2.2662 | 2.2107 | 2.1646 | 2.0921 | 2.0148 | 1.9317 | 1.8874 | 1.8409 | 1.7918 | 1.7396 | 1.6835 | 1.6223 |
| 40 | 4.0847 | 3.2317 | 2.8387 | 2.606 | 2.4495 | 2.3359 | 2.249 | 2.1802 | 2.124 | 2.0772 | 2.0035 | 1.9245 | 1.8389 | 1.7929 | 1.7444 | 1.6928 | 1.6373 | 1.5766 | 1.5089 |
| 60 | 4.0012 | 3.1504 | 2.7581 | 2.5252 | 2.3683 | 2.2541 | 2.1665 | 2.097 | 2.0401 | 1.9926 | 1.9174 | 1.8364 | 1.748 | 1.7001 | 1.6491 | 1.5943 | 1.5343 | 1.4673 | 1.3893 |
| 120 | 3.9201 | 3.0718 | 2.6802 | 2.4472 | 2.2899 | 2.175 | 2.0868 | 2.0164 | 1.9588 | 1.9105 | 1.8337 | 1.7505 | 1.6587 | 1.6084 | 1.5543 | 1.4952 | 1.429 | 1.3519 | 1.2539 |
| Inf | 3.8415 | 2.9957 | 2.6049 | 2.3719 | 2.2141 | 2.0986 | 2.0096 | 1.9384 | 1.8799 | 1.8307 | 1.7522 | 1.6664 | 1.5705 | 1.5173 | 1.4591 | 1.394 | 1.318 | 1.2214 | 1 |

Since the calculated F-statistic of **5.09** exceeds the table's **critical value** of **4.2565**, the researcher can conclude that the **regression analysis** is statistically significant. This means that at least one of the predictor variables--hours studied or prep exams--has a significant impact on the final exam scores. Such a result allows the researcher to move forward with interpreting the individual coefficients of the model, knowing that the overall model provides a better fit than a null model.

## Executing One-Way ANOVA with the F-Distribution Table

Another common application of the **F-distribution table** is in **ANOVA**, which is used to test whether the means of three or more groups are significantly different from each other. Imagine a researcher testing three different studying techniques with 60 students, randomly assigning 20 students to each group. After a month of preparation, the students take an exam, and the researcher performs a one-way **ANOVA** to see if the technique used influenced the scores. The results are summarized in an ANOVA table, showing the variance attributed to the treatment versus the variance attributed to error.

| Source | SS | df | MS | F | P |
|---|---|---|---|---|---|
| Treatment | 58.8 | 2 | 29.4 | 1.74 | 0.217 |

| Source | SS | df | MS | F | P |
|---|---|---|---|---|---|
| Error | 202.8 | 12 | 16.9 | | |
| Total | 261.6 | 14 | | | |

In this **ANOVA** example, the F-statistic is determined by dividing the Treatment Mean Square (29.4) by the Error Mean Square (16.9), resulting in an **F-statistic of 1.74**. To interpret this, we refer to the **F-distribution table** using an **alpha level** of 0.05, with 2 **degrees of freedom** for the numerator and 12 degrees of freedom for the denominator. Looking at the table provided below, the **critical value** is identified as **3.8853**.

| | DF1 | α = 0.05 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DF2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 15 | 20 | 24 | 30 | 40 | 60 | 120 | Inf |
| 1 | 161.45 | 199.5 | 215.71 | 224.58 | 230.16 | 233.99 | 236.77 | 238.88 | 240.54 | 241.88 | 243.91 | 245.95 | 248.01 | 249.05 | 250.1 | 251.14 | 252.2 | 253.25 | 254.31 |
| 2 | 18.513 | 19 | 19.164 | 19.247 | 19.296 | 19.33 | 19.353 | 19.371 | 19.385 | 19.396 | 19.413 | 19.429 | 19.446 | 19.454 | 19.462 | 19.471 | 19.479 | 19.487 | 19.496 |
| 3 | 10.128 | 9.5521 | 9.2766 | 9.1172 | 9.0135 | 8.9406 | 8.8867 | 8.8452 | 8.8123 | 8.7855 | 8.7446 | 8.7029 | 8.6602 | 8.6385 | 8.6166 | 8.5944 | 8.572 | 8.5494 | 8.5264 |
| 4 | 7.7086 | 6.9443 | 6.5914 | 6.3882 | 6.2561 | 6.1631 | 6.0942 | 6.041 | 5.9988 | 5.9644 | 5.9117 | 5.8578 | 5.8025 | 5.7744 | 5.7459 | 5.717 | 5.6877 | 5.6581 | 5.6281 |
| 5 | 6.6079 | 5.7861 | 5.4095 | 5.1922 | 5.0503 | 4.9503 | 4.8759 | 4.8183 | 4.7725 | 4.7351 | 4.6777 | 4.6188 | 4.5581 | 4.5272 | 4.4957 | 4.4638 | 4.4314 | 4.3985 | 4.365 |
| 6 | 5.9874 | 5.1433 | 4.7571 | 4.5337 | 4.3874 | 4.2839 | 4.2067 | 4.1468 | 4.099 | 4.06 | 3.9999 | 3.9381 | 3.8742 | 3.8415 | 3.8082 | 3.7743 | 3.7398 | 3.7047 | 3.6689 |
| 7 | 5.5914 | 4.7374 | 4.3468 | 4.1203 | 3.9715 | 3.866 | 3.787 | 3.7257 | 3.6767 | 3.6365 | 3.5747 | 3.5107 | 3.4445 | 3.4105 | 3.3758 | 3.3404 | 3.3043 | 3.2674 | 3.2298 |
| 8 | 5.3177 | 4.459 | 4.0662 | 3.8379 | 3.6875 | 3.5806 | 3.5005 | 3.4381 | 3.3881 | 3.3472 | 3.2839 | 3.2184 | 3.1503 | 3.1152 | 3.0794 | 3.0428 | 3.0053 | 2.9669 | 2.9276 |
| 9 | 5.1174 | 4.2565 | 3.8625 | 3.6331 | 3.4817 | 3.3738 | 3.2927 | 3.2296 | 3.1789 | 3.1373 | 3.0729 | 3.0061 | 2.9365 | 2.9005 | 2.8637 | 2.8259 | 2.7872 | 2.7475 | 2.7067 |
| 10 | 4.9646 | 4.1028 | 3.7083 | 3.478 | 3.3258 | 3.2172 | 3.1355 | 3.0717 | 3.0204 | 2.9782 | 2.913 | 2.845 | 2.774 | 2.7372 | 2.6996 | 2.6609 | 2.6211 | 2.5801 | 2.5379 |
| 11 | 4.8443 | 3.9823 | 3.5874 | 3.3567 | 3.2039 | 3.0946 | 3.0123 | 2.948 | 2.8962 | 2.8536 | 2.7876 | 2.7186 | 2.6464 | 2.609 | 2.5705 | 2.5309 | 2.4901 | 2.448 | 2.4045 |
| 12 | 4.7472 | 3.8853 | 3.4903 | 3.2592 | 3.1059 | 2.9961 | 2.9134 | 2.8486 | 2.7964 | 2.7534 | 2.6866 | 2.6169 | 2.5436 | 2.5055 | 2.4663 | 2.4259 | 2.3842 | 2.341 | 2.2962 |
| 13 | 4.6672 | 3.8056 | 3.4105 | 3.1791 | 3.0254 | 2.9153 | 2.8321 | 2.7669 | 2.7144 | 2.671 | 2.6037 | 2.5331 | 2.4589 | 2.4202 | 2.3803 | 2.3392 | 2.2966 | 2.2524 | 2.2064 |
| 14 | 4.6001 | 3.7389 | 3.3439 | 3.1122 | 2.9582 | 2.8477 | 2.7642 | 2.6987 | 2.6458 | 2.6022 | 2.5342 | 2.463 | 2.3879 | 2.3487 | 2.3082 | 2.2664 | 2.2229 | 2.1778 | 2.1307 |
| 15 | 4.5431 | 3.6823 | 3.2874 | 3.0556 | 2.9013 | 2.7905 | 2.7066 | 2.6408 | 2.5876 | 2.5437 | 2.4753 | 2.4034 | 2.3275 | 2.2878 | 2.2468 | 2.2043 | 2.1601 | 2.1141 | 2.0658 |
| 16 | 4.494 | 3.6337 | 3.2389 | 3.0069 | 2.8524 | 2.7413 | 2.6572 | 2.5911 | 2.5377 | 2.4935 | 2.4247 | 2.3522 | 2.2756 | 2.2354 | 2.1938 | 2.1507 | 2.1058 | 2.0589 | 2.0096 |
| 17 | 4.4513 | 3.5915 | 3.1968 | 2.9647 | 2.81 | 2.6987 | 2.6143 | 2.548 | 2.4943 | 2.4499 | 2.3807 | 2.3077 | 2.2304 | 2.1898 | 2.1477 | 2.104 | 2.0584 | 2.0107 | 1.9604 |
| 18 | 4.4139 | 3.5546 | 3.1599 | 2.9277 | 2.7729 | 2.6613 | 2.5767 | 2.5102 | 2.4563 | 2.4117 | 2.3421 | 2.2686 | 2.1906 | 2.1497 | 2.1071 | 2.0629 | 2.0166 | 1.9681 | 1.9168 |
| 19 | 4.3807 | 3.5219 | 3.1274 | 2.8951 | 2.7401 | 2.6283 | 2.5435 | 2.4768 | 2.4227 | 2.3779 | 2.308 | 2.2341 | 2.1555 | 2.1141 | 2.0712 | 2.0264 | 1.9795 | 1.9302 | 1.878 |
| 20 | 4.3512 | 3.4928 | 3.0984 | 2.8661 | 2.7109 | 2.599 | 2.514 | 2.4471 | 2.3928 | 2.3479 | 2.2776 | 2.2033 | 2.1242 | 2.0825 | 2.0391 | 1.9938 | 1.9464 | 1.8963 | 1.8432 |
| 21 | 4.3248 | 3.4668 | 3.0725 | 2.8401 | 2.6848 | 2.5727 | 2.4876 | 2.4205 | 2.366 | 2.321 | 2.2504 | 2.1757 | 2.096 | 2.054 | 2.0102 | 1.9645 | 1.9165 | 1.8657 | 1.8117 |
| 22 | 4.3009 | 3.4434 | 3.0491 | 2.8167 | 2.6613 | 2.5491 | 2.4638 | 2.3965 | 2.3419 | 2.2967 | 2.2258 | 2.1508 | 2.0707 | 2.0283 | 1.9842 | 1.938 | 1.8894 | 1.838 | 1.7831 |
| 23 | 4.2793 | 3.4221 | 3.028 | 2.7955 | 2.64 | 2.5277 | 2.4422 | 2.3748 | 2.3201 | 2.2747 | 2.2036 | 2.1282 | 2.0476 | 2.005 | 1.9605 | 1.9139 | 1.8648 | 1.8128 | 1.757 |
| 24 | 4.2597 | 3.4028 | 3.0088 | 2.7763 | 2.6207 | 2.5082 | 2.4226 | 2.3551 | 2.3002 | 2.2547 | 2.1834 | 2.1077 | 2.0267 | 1.9838 | 1.939 | 1.892 | 1.8424 | 1.7896 | 1.733 |
| 25 | 4.2417 | 3.3852 | 2.9912 | 2.7587 | 2.603 | 2.4904 | 2.4047 | 2.3371 | 2.2821 | 2.2365 | 2.1649 | 2.0889 | 2.0075 | 1.9643 | 1.9192 | 1.8718 | 1.8217 | 1.7684 | 1.711 |
| 26 | 4.2252 | 3.369 | 2.9752 | 2.7426 | 2.5868 | 2.4741 | 2.3883 | 2.3205 | 2.2655 | 2.2197 | 2.1479 | 2.0716 | 1.9898 | 1.9464 | 1.901 | 1.8533 | 1.8027 | 1.7488 | 1.6906 |
| 27 | 4.21 | 3.3541 | 2.9604 | 2.7278 | 2.5719 | 2.4591 | 2.3732 | 2.3053 | 2.2501 | 2.2043 | 2.1323 | 2.0558 | 1.9736 | 1.9299 | 1.8842 | 1.8361 | 1.7851 | 1.7306 | 1.6717 |
| 28 | 4.196 | 3.3404 | 2.9467 | 2.7141 | 2.5581 | 2.4453 | 2.3593 | 2.2913 | 2.236 | 2.19 | 2.1179 | 2.0411 | 1.9586 | 1.9147 | 1.8687 | 1.8203 | 1.7689 | 1.7138 | 1.6541 |
| 29 | 4.183 | 3.3277 | 2.934 | 2.7014 | 2.5454 | 2.4324 | 2.3463 | 2.2783 | 2.2229 | 2.1768 | 2.1045 | 2.0275 | 1.9446 | 1.9005 | 1.8543 | 1.8055 | 1.7537 | 1.6981 | 1.6376 |
| 30 | 4.1709 | 3.3158 | 2.9223 | 2.6896 | 2.5336 | 2.4205 | 2.3343 | 2.2662 | 2.2107 | 2.1646 | 2.0921 | 2.0148 | 1.9317 | 1.8874 | 1.8409 | 1.7918 | 1.7396 | 1.6835 | 1.6223 |
| 40 | 4.0847 | 3.2317 | 2.8387 | 2.606 | 2.4495 | 2.3359 | 2.249 | 2.1802 | 2.124 | 2.0772 | 2.0035 | 1.9245 | 1.8389 | 1.7929 | 1.7444 | 1.6928 | 1.6373 | 1.5766 | 1.5089 |
| 60 | 4.0012 | 3.1504 | 2.7581 | 2.5252 | 2.3683 | 2.2541 | 2.1665 | 2.097 | 2.0401 | 1.9926 | 1.9174 | 1.8364 | 1.748 | 1.7001 | 1.6491 | 1.5943 | 1.5343 | 1.4673 | 1.3893 |
| 120 | 3.9201 | 3.0718 | 2.6802 | 2.4472 | 2.2899 | 2.175 | 2.0868 | 2.0164 | 1.9588 | 1.9105 | 1.8337 | 1.7505 | 1.6587 | 1.6084 | 1.5543 | 1.4952 | 1.429 | 1.3519 | 1.2539 |
| Inf | 3.8415 | 2.9957 | 2.6049 | 2.3719 | 2.2141 | 2.0986 | 2.0096 | 1.9384 | 1.8799 | 1.8307 | 1.7522 | 1.6664 | 1.5705 | 1.5173 | 1.4591 | 1.394 | 1.318 | 1.2214 | 1 |



Comparing the calculated F-statistic of **1.74** to the critical value of **3.8853** reveals that the statistic is not large enough to reach the threshold of **statistical significance**. Therefore, the researcher fails to reject the **null hypothesis**. The conclusion is that there is no significant difference between the mean exam scores produced by the three different studying techniques. This insight is crucial for educators, as it suggests that factors other than the specific technique might be influencing the outcomes.

## Testing for Equality of Variances Between Populations

The **F-distribution table** is also essential when researchers need to determine if two independent populations have equal **variances**. This is often a prerequisite for other tests, such as the two-sample T-test. To perform this F-test, a researcher takes a random sample from each population and calculates the sample variances. The test statistic is simply the ratio of the two variances: **$F = s1^2 / s2^2$**. The further this ratio deviates from 1.0, the more likely it is that the population variances are unequal.

To find the **critical value** for this test, one uses the **F-distribution table** with **degrees of freedom** defined as n1-1 and n2-1. For instance, if two samples of 25 observations each are taken, both the numerator and denominator degrees of freedom would be 24. If the sample variance for the first group is 30.5 and the second is 20.5, the calculated F-statistic is **1.487**. Using an **alpha level** of 0.10, the critical value from the table is **1.7019**.

| | DF1 | α = 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 |

Because the calculated F-statistic (**1.487**) is less than the **critical value** (**1.7019**), we conclude that the difference in **variances** is not statistically significant. In practical terms, this means the researcher can assume the populations have equal variances for further statistical modeling. This specific use of the **F-distribution table** highlights its versatility in validating the assumptions that underpin many advanced statistical procedures.

## Advanced Considerations in Statistical Significance and Alpha Levels

While the examples provided focus on common **alpha levels** like 0.05 and 0.10, the **F-distribution**

**table** can accommodate a wide range of significance thresholds. In highly sensitive fields such as medical research or structural engineering, a more stringent alpha level like 0.01 or even 0.001 may be required to minimize the risk of a false positive. Selecting a smaller alpha level increases the **critical value**, making it harder to reject the **null hypothesis** and ensuring that any claimed effect is highly likely to be real.

It is also important to note that the **F-distribution** is inherently a one-tailed distribution because variances are always positive, resulting in positive F-ratios. However, when testing for equal variances, researchers might be interested in whether one variance is significantly larger *or* smaller than the other, which effectively requires a two-tailed interpretation. Most **F-distribution tables** are formatted for one-tailed tests, so researchers must be careful to adjust their **alpha level** (e.g., using alpha/2) if they are performing a two-tailed evaluation of **variance** equality.

The relationship between the F-statistic and the **p-value** is another critical aspect of modern **statistics**. While the table provides a fixed threshold, the p-value represents the exact probability of obtaining a result as extreme as the observed F-statistic. If the p-value is less than the chosen **alpha level**, the result is significant. The **F-distribution table** remains the primary way for students and researchers to understand where these p-values come from and how they relate to the underlying geometry of the distribution.

## Conclusion and Resources for Further Statistical Study

In conclusion, the **F-Distribution Table** is a vital resource that bridges the gap between raw data and **statistical significance**. Whether you are performing a complex **regression analysis**, conducting a multi-group **ANOVA**, or simply checking the assumptions of your data's **variance**, the table provides the objective benchmarks needed for accurate interpretation. By understanding the relationship between **degrees of freedom** and **critical values**, researchers can ensure their work stands up to the rigors of scientific scrutiny.

For those looking to deepen their understanding of probability distributions, exploring a full range of tables for different significance levels is highly recommended. Standard sets usually include tables for alpha values of 0.001, 0.01, 0.025, 0.05, and 0.10. Utilizing these resources allows for more precise hypothesis testing and a better grasp of how changes in sample size or significance thresholds affect experimental conclusions. As you continue your journey in **statistics**, the **F-distribution table** will remain a constant and reliable companion in your analytical toolkit.

For a complete set of F-distribution tables covering various alpha values, including 0.001, 0.01, 0.025, 0.05, and 0.10, you may consult specialized statistical appendices or official documentation. These comprehensive resources provide the precision necessary for advanced academic research and professional data analysis across all scientific disciplines.