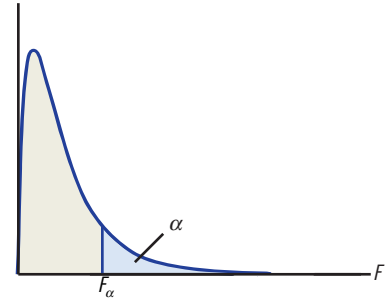


Critical Values of the F -Distribution ($\alpha = 0.025$)

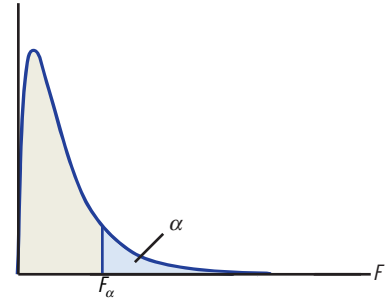


Numerator Degrees of Freedom

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1 | 647.7890 | 799.5000 | 864.1630 | 899.5833 | 921.8479 | 937.1111 | 948.2169 | 956.6562 | 963.2846 |
| 2 | 38.5063 | 39.0000 | 39.1655 | 39.2484 | 39.2982 | 39.3315 | 39.3552 | 39.3730 | 39.3869 |
| 3 | 17.4434 | 16.0441 | 15.4392 | 15.1010 | 14.8848 | 14.7347 | 14.6244 | 14.5399 | 14.4731 |
| 4 | 12.2179 | 10.6491 | 9.9792 | 9.6045 | 9.3645 | 9.1973 | 9.0741 | 8.9796 | 8.9047 |
| 5 | 10.0070 | 8.4336 | 7.7636 | 7.3879 | 7.1464 | 6.9777 | 6.8531 | 6.7572 | 6.6811 |
| 6 | 8.8131 | 7.2599 | 6.5988 | 6.2272 | 5.9876 | 5.8198 | 5.6955 | 5.5996 | 5.5234 |
| 7 | 8.0727 | 6.5415 | 5.8898 | 5.5226 | 5.2852 | 5.1186 | 4.9949 | 4.8993 | 4.8232 |
| 8 | 7.5709 | 6.0595 | 5.4160 | 5.0526 | 4.8173 | 4.6517 | 4.5286 | 4.4333 | 4.3572 |
| 9 | 7.2093 | 5.7147 | 5.0781 | 4.7181 | 4.4844 | 4.3197 | 4.1970 | 4.1020 | 4.0260 |
| 10 | 6.9367 | 5.4564 | 4.8256 | 4.4683 | 4.2361 | 4.0721 | 3.9498 | 3.8549 | 3.7790 |
| 11 | 6.7241 | 5.2559 | 4.6300 | 4.2751 | 4.0440 | 3.8807 | 3.7586 | 3.6638 | 3.5879 |
| 12 | 6.5538 | 5.0959 | 4.4742 | 4.1212 | 3.8911 | 3.7283 | 3.6065 | 3.5118 | 3.4358 |
| 13 | 6.4143 | 4.9653 | 4.3472 | 3.9959 | 3.7667 | 3.6043 | 3.4827 | 3.3880 | 3.3120 |
| 14 | 6.2979 | 4.8567 | 4.2417 | 3.8919 | 3.6634 | 3.5014 | 3.3799 | 3.2853 | 3.2093 |
| 15 | 6.1995 | 4.7650 | 4.1528 | 3.8043 | 3.5764 | 3.4147 | 3.2934 | 3.1987 | 3.1227 |
| 16 | 6.1151 | 4.6867 | 4.0768 | 3.7294 | 3.5021 | 3.3406 | 3.2194 | 3.1248 | 3.0488 |
| 17 | 6.0420 | 4.6189 | 4.0112 | 3.6648 | 3.4379 | 3.2767 | 3.1556 | 3.0610 | 2.9849 |
| 18 | 5.9781 | 4.5597 | 3.9539 | 3.6083 | 3.3820 | 3.2209 | 3.0999 | 3.0053 | 2.9291 |
| 19 | 5.9216 | 4.5075 | 3.9034 | 3.5587 | 3.3327 | 3.1718 | 3.0509 | 2.9563 | 2.8801 |
| 20 | 5.8715 | 4.4613 | 3.8587 | 3.5147 | 3.2891 | 3.1283 | 3.0074 | 2.9128 | 2.8365 |
| 21 | 5.8266 | 4.4199 | 3.8188 | 3.4754 | 3.2501 | 3.0895 | 2.9686 | 2.8740 | 2.7977 |
| 22 | 5.7863 | 4.3828 | 3.7829 | 3.4401 | 3.2151 | 3.0546 | 2.9338 | 2.8392 | 2.7628 |
| 23 | 5.7498 | 4.3492 | 3.7505 | 3.4083 | 3.1835 | 3.0232 | 2.9023 | 2.8077 | 2.7313 |
| 24 | 5.7166 | 4.3187 | 3.7211 | 3.3794 | 3.1548 | 2.9946 | 2.8738 | 2.7791 | 2.7027 |
| 25 | 5.6864 | 4.2909 | 3.6943 | 3.3530 | 3.1287 | 2.9685 | 2.8478 | 2.7531 | 2.6766 |
| 26 | 5.6586 | 4.2655 | 3.6697 | 3.3289 | 3.1048 | 2.9447 | 2.8240 | 2.7293 | 2.6528 |
| 27 | 5.6331 | 4.2421 | 3.6472 | 3.3067 | 3.0828 | 2.9228 | 2.8021 | 2.7074 | 2.6309 |
| 28 | 5.6096 | 4.2205 | 3.6264 | 3.2863 | 3.0626 | 2.9027 | 2.7820 | 2.6872 | 2.6106 |
| 29 | 5.5878 | 4.2006 | 3.6072 | 3.2674 | 3.0438 | 2.8840 | 2.7633 | 2.6686 | 2.5919 |
| 30 | 5.5675 | 4.1821 | 3.5894 | 3.2499 | 3.0265 | 2.8667 | 2.7460 | 2.6513 | 2.5746 |
| 40 | 5.4239 | 4.0510 | 3.4633 | 3.1261 | 2.9037 | 2.7444 | 2.6238 | 2.5289 | 2.4519 |
| 60 | 5.2856 | 3.9253 | 3.3425 | 3.0077 | 2.7863 | 2.6274 | 2.5068 | 2.4117 | 2.3344 |
| 120 | 5.1523 | 3.8046 | 3.2269 | 2.8943 | 2.6740 | 2.5154 | 2.3948 | 2.2994 | 2.2217 |
| ∞ | 5.0239 | 3.6889 | 3.1161 | 2.7858 | 2.5665 | 2.4082 | 2.2875 | 2.1918 | 2.1136 |

Denominator Degrees of Freedom

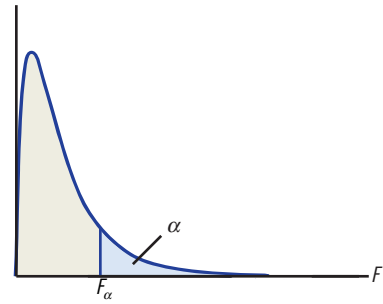
Critical Values of the F -Distribution ($\alpha = 0.025$) (continued)



Numerator Degrees of Freedom

| | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|--------------------------------|--------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Denominator Degrees of Freedom | 1 | 968.6274 | 973.0252 | 976.7079 | 979.8368 | 982.5278 | 984.8668 | 986.9187 | 988.7331 | 990.3490 |
| | 2 | 39.3980 | 39.4071 | 39.4146 | 39.4210 | 39.4265 | 39.4313 | 39.4354 | 39.4391 | 39.4424 |
| | 3 | 14.4189 | 14.3742 | 14.3366 | 14.3045 | 14.2768 | 14.2527 | 14.2315 | 14.2127 | 14.1960 |
| | 4 | 8.8439 | 8.7935 | 8.7512 | 8.7150 | 8.6838 | 8.6565 | 8.6326 | 8.6113 | 8.5924 |
| | 5 | 6.6192 | 6.5678 | 6.5245 | 6.4876 | 6.4556 | 6.4277 | 6.4032 | 6.3814 | 6.3619 |
| | 6 | 5.4613 | 5.4098 | 5.3662 | 5.3290 | 5.2968 | 5.2687 | 5.2439 | 5.2218 | 5.2021 |
| | 7 | 4.7611 | 4.7095 | 4.6658 | 4.6285 | 4.5961 | 4.5678 | 4.5428 | 4.5206 | 4.5008 |
| | 8 | 4.2951 | 4.2434 | 4.1997 | 4.1622 | 4.1297 | 4.1012 | 4.0761 | 4.0538 | 4.0338 |
| | 9 | 3.9639 | 3.9121 | 3.8682 | 3.8306 | 3.7980 | 3.7694 | 3.7441 | 3.7216 | 3.7015 |
| | 10 | 3.7168 | 3.6649 | 3.6209 | 3.5832 | 3.5504 | 3.5217 | 3.4963 | 3.4737 | 3.4534 |
| | 11 | 3.5257 | 3.4737 | 3.4296 | 3.3917 | 3.3588 | 3.3299 | 3.3044 | 3.2816 | 3.2612 |
| | 12 | 3.3736 | 3.3215 | 3.2773 | 3.2393 | 3.2062 | 3.1772 | 3.1515 | 3.1286 | 3.1081 |
| | 13 | 3.2497 | 3.1975 | 3.1532 | 3.1150 | 3.0819 | 3.0527 | 3.0269 | 3.0039 | 2.9832 |
| | 14 | 3.1469 | 3.0946 | 3.0502 | 3.0119 | 2.9786 | 2.9493 | 2.9234 | 2.9003 | 2.8795 |
| | 15 | 3.0602 | 3.0078 | 2.9633 | 2.9249 | 2.8915 | 2.8621 | 2.8360 | 2.8128 | 2.7919 |
| | 16 | 2.9862 | 2.9337 | 2.8890 | 2.8506 | 2.8170 | 2.7875 | 2.7614 | 2.7380 | 2.7170 |
| | 17 | 2.9222 | 2.8696 | 2.8249 | 2.7863 | 2.7526 | 2.7230 | 2.6968 | 2.6733 | 2.6522 |
| | 18 | 2.8664 | 2.8137 | 2.7689 | 2.7302 | 2.6964 | 2.6667 | 2.6404 | 2.6168 | 2.5956 |
| | 19 | 2.8172 | 2.7645 | 2.7196 | 2.6808 | 2.6469 | 2.6171 | 2.5907 | 2.5670 | 2.5457 |
| | 20 | 2.7737 | 2.7209 | 2.6758 | 2.6369 | 2.6030 | 2.5731 | 2.5465 | 2.5228 | 2.5014 |
| | 21 | 2.7348 | 2.6819 | 2.6368 | 2.5978 | 2.5638 | 2.5338 | 2.5071 | 2.4833 | 2.4618 |
| | 22 | 2.6998 | 2.6469 | 2.6017 | 2.5626 | 2.5285 | 2.4984 | 2.4717 | 2.4478 | 2.4262 |
| | 23 | 2.6682 | 2.6152 | 2.5699 | 2.5308 | 2.4966 | 2.4665 | 2.4396 | 2.4157 | 2.3940 |
| | 24 | 2.6396 | 2.5865 | 2.5411 | 2.5019 | 2.4677 | 2.4374 | 2.4105 | 2.3865 | 2.3648 |
| | 25 | 2.6135 | 2.5603 | 2.5149 | 2.4756 | 2.4413 | 2.4110 | 2.3840 | 2.3599 | 2.3381 |
| | 26 | 2.5896 | 2.5363 | 2.4908 | 2.4515 | 2.4171 | 2.3867 | 2.3597 | 2.3355 | 2.3137 |
| | 27 | 2.5676 | 2.5143 | 2.4688 | 2.4293 | 2.3949 | 2.3644 | 2.3373 | 2.3131 | 2.2912 |
| | 28 | 2.5473 | 2.4940 | 2.4484 | 2.4089 | 2.3743 | 2.3438 | 2.3167 | 2.2924 | 2.2704 |
| | 29 | 2.5286 | 2.4752 | 2.4295 | 2.3900 | 2.3554 | 2.3248 | 2.2976 | 2.2732 | 2.2512 |
| | 30 | 2.5112 | 2.4577 | 2.4120 | 2.3724 | 2.3378 | 2.3072 | 2.2799 | 2.2554 | 2.2334 |
| | 40 | 2.3882 | 2.3343 | 2.2882 | 2.2481 | 2.2130 | 2.1819 | 2.1542 | 2.1293 | 2.1068 |
| 60 | 2.2702 | 2.2159 | 2.1692 | 2.1286 | 2.0929 | 2.0613 | 2.0330 | 2.0076 | 1.9846 | |
| 120 | 2.1570 | 2.1021 | 2.0548 | 2.0136 | 1.9773 | 1.9450 | 1.9161 | 1.8900 | 1.8663 | |
| ∞ | 2.0483 | 1.9927 | 1.9447 | 1.9027 | 1.8656 | 1.8326 | 1.8028 | 1.7759 | 1.7515 | |

Critical Values of the F -Distribution ($\alpha = 0.025$) (continued)



Numerator Degrees of Freedom

| Denominator Degrees of Freedom | Numerator Degrees of Freedom | | | | | | |
|--------------------------------|------------------------------|----------|----------|-----------|-----------|-----------|-----------|
| | 19 | 20 | 24 | 30 | 40 | 60 | 120 |
| 1 | 991.7973 | 993.1028 | 997.2492 | 1001.4144 | 1005.5981 | 1009.8001 | 1014.0202 |
| 2 | 39.4453 | 39.4479 | 39.4562 | 39.4646 | 39.4729 | 39.4812 | 39.4896 |
| 3 | 14.1810 | 14.1674 | 14.1241 | 14.0805 | 14.0365 | 13.9921 | 13.9473 |
| 4 | 8.5753 | 8.5599 | 8.5109 | 8.4613 | 8.4111 | 8.3604 | 8.3092 |
| 5 | 6.3444 | 6.3286 | 6.2780 | 6.2269 | 6.1750 | 6.1225 | 6.0693 |
| 6 | 5.1844 | 5.1684 | 5.1172 | 5.0652 | 5.0125 | 4.9589 | 4.9044 |
| 7 | 4.4829 | 4.4667 | 4.4150 | 4.3624 | 4.3089 | 4.2544 | 4.1989 |
| 8 | 4.0158 | 3.9995 | 3.9472 | 3.8940 | 3.8398 | 3.7844 | 3.7279 |
| 9 | 3.6833 | 3.6669 | 3.6142 | 3.5604 | 3.5055 | 3.4493 | 3.3918 |
| 10 | 3.4351 | 3.4185 | 3.3654 | 3.3110 | 3.2554 | 3.1984 | 3.1399 |
| 11 | 3.2428 | 3.2261 | 3.1725 | 3.1176 | 3.0613 | 3.0035 | 2.9441 |
| 12 | 3.0896 | 3.0728 | 3.0187 | 2.9633 | 2.9063 | 2.8478 | 2.7874 |
| 13 | 2.9646 | 2.9477 | 2.8932 | 2.8372 | 2.7797 | 2.7204 | 2.6590 |
| 14 | 2.8607 | 2.8437 | 2.7888 | 2.7324 | 2.6742 | 2.6142 | 2.5519 |
| 15 | 2.7730 | 2.7559 | 2.7006 | 2.6437 | 2.5850 | 2.5242 | 2.4611 |
| 16 | 2.6980 | 2.6808 | 2.6252 | 2.5678 | 2.5085 | 2.4471 | 2.3831 |
| 17 | 2.6331 | 2.6158 | 2.5598 | 2.5020 | 2.4422 | 2.3801 | 2.3153 |
| 18 | 2.5764 | 2.5590 | 2.5027 | 2.4445 | 2.3842 | 2.3214 | 2.2558 |
| 19 | 2.5265 | 2.5089 | 2.4523 | 2.3937 | 2.3329 | 2.2696 | 2.2032 |
| 20 | 2.4821 | 2.4645 | 2.4076 | 2.3486 | 2.2873 | 2.2234 | 2.1562 |
| 21 | 2.4424 | 2.4247 | 2.3675 | 2.3082 | 2.2465 | 2.1819 | 2.1141 |
| 22 | 2.4067 | 2.3890 | 2.3315 | 2.2718 | 2.2097 | 2.1446 | 2.0760 |
| 23 | 2.3745 | 2.3567 | 2.2989 | 2.2389 | 2.1763 | 2.1107 | 2.0415 |
| 24 | 2.3452 | 2.3273 | 2.2693 | 2.2090 | 2.1460 | 2.0799 | 2.0099 |
| 25 | 2.3184 | 2.3005 | 2.2422 | 2.1816 | 2.1183 | 2.0516 | 1.9811 |
| 26 | 2.2939 | 2.2759 | 2.2174 | 2.1565 | 2.0928 | 2.0257 | 1.9545 |
| 27 | 2.2713 | 2.2533 | 2.1946 | 2.1334 | 2.0693 | 2.0018 | 1.9299 |
| 28 | 2.2505 | 2.2324 | 2.1735 | 2.1121 | 2.0477 | 1.9797 | 1.9072 |
| 29 | 2.2313 | 2.2131 | 2.1540 | 2.0923 | 2.0276 | 1.9591 | 1.8861 |
| 30 | 2.2134 | 2.1952 | 2.1359 | 2.0739 | 2.0089 | 1.9400 | 1.8664 |
| 40 | 2.0864 | 2.0677 | 2.0069 | 1.9429 | 1.8752 | 1.8028 | 1.7242 |
| 60 | 1.9636 | 1.9445 | 1.8817 | 1.8152 | 1.7440 | 1.6668 | 1.5810 |
| 120 | 1.8447 | 1.8249 | 1.7597 | 1.6899 | 1.6141 | 1.5299 | 1.4327 |
| ∞ | 1.7291 | 1.7085 | 1.6402 | 1.5660 | 1.4835 | 1.3883 | 1.2684 |