

**Table T.5**

Upper  $\alpha$  Probability Points of Central  $F$  Distribution with  $n_1$  d.f. in Numerator and  $n_2$  d.f. in Denominator

Entries are  $F_{\alpha; n_1, n_2}$

| $\alpha$ | $n_2 \backslash n_1$ | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     | 12     | 15     | 20     | 30     | 60     | 120    | $\infty$ |
|----------|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|
| 0.10     | 1                    | 39.9   | 49.5   | 53.6   | 55.8   | 57.2   | 58.2   | 58.9   | 59.4   | 59.9   | 60.2   | 60.7   | 61.2   | 61.7   | 62.3   | 62.8   | 63.1   | 63.3     |
| 0.05     | 1                    | 161    | 200    | 216    | 225    | 230    | 234    | 237    | 239    | 241    | 242    | 244    | 246    | 248    | 250    | 252    | 253    | 254      |
| 0.025    | 1                    | 648    | 800    | 864    | 900    | 922    | 937    | 948    | 957    | 963    | 969    | 977    | 985    | 993    | 1000   | 1010   | 1010   | 1020     |
| 0.01     | 1                    | 4,050  | 5,000  | 5,400  | 5,620  | 5,760  | 5,860  | 5,930  | 5,980  | 6,020  | 6,060  | 6,110  | 6,160  | 6,210  | 6,260  | 6,310  | 6,340  | 6,370    |
| 0.005    | 1                    | 16,200 | 20,000 | 21,600 | 22,500 | 23,100 | 23,400 | 23,700 | 23,900 | 24,100 | 24,200 | 24,400 | 24,600 | 24,800 | 25,000 | 25,200 | 25,400 | 25,500   |
| 0.10     | 2                    | 8.53   | 9.00   | 9.16   | 9.24   | 9.29   | 9.33   | 9.35   | 9.37   | 9.38   | 9.39   | 9.41   | 9.42   | 9.44   | 9.46   | 9.47   | 9.48   | 9.49     |
| 0.05     | 2                    | 18.5   | 19.0   | 19.2   | 19.3   | 19.3   | 19.3   | 19.4   | 19.4   | 19.4   | 19.4   | 19.4   | 19.4   | 19.5   | 19.5   | 19.5   | 19.5   | 19.5     |
| 0.025    | 2                    | 38.5   | 39.0   | 39.2   | 39.2   | 39.3   | 39.3   | 39.4   | 39.4   | 39.4   | 39.4   | 39.4   | 39.4   | 39.4   | 39.5   | 39.5   | 39.5   | 39.5     |
| 0.01     | 2                    | 98.5   | 99.0   | 99.2   | 99.2   | 99.3   | 99.3   | 99.4   | 99.4   | 99.4   | 99.4   | 99.4   | 99.4   | 99.4   | 99.5   | 99.5   | 99.5   | 99.5     |
| 0.005    | 2                    | 199    | 199    | 199    | 199    | 199    | 199    | 199    | 199    | 199    | 199    | 199    | 199    | 199    | 199    | 199    | 199    | 199      |
| 0.10     | 3                    | 5.54   | 5.46   | 5.39   | 5.34   | 5.31   | 5.28   | 5.27   | 5.25   | 5.24   | 5.23   | 5.22   | 5.20   | 5.18   | 5.17   | 5.15   | 5.14   | 5.13     |
| 0.05     | 3                    | 10.1   | 9.55   | 9.28   | 9.12   | 9.01   | 8.94   | 8.89   | 8.85   | 8.81   | 8.79   | 8.74   | 8.70   | 8.66   | 8.62   | 8.57   | 8.55   | 8.53     |
| 0.025    | 3                    | 17.4   | 16.0   | 15.4   | 15.1   | 14.9   | 14.7   | 14.6   | 14.5   | 14.4   | 14.4   | 14.3   | 14.3   | 14.2   | 14.1   | 14.0   | 13.9   | 13.9     |
| 0.01     | 3                    | 34.1   | 30.8   | 29.5   | 28.7   | 28.2   | 27.9   | 27.7   | 27.5   | 27.3   | 27.2   | 27.1   | 26.9   | 26.7   | 26.5   | 26.3   | 26.2   | 26.1     |
| 0.005    | 3                    | 55.6   | 49.8   | 47.5   | 46.2   | 45.4   | 44.8   | 44.4   | 44.1   | 43.9   | 43.7   | 43.4   | 43.1   | 42.8   | 42.5   | 42.1   | 42.0   | 41.8     |
| 0.10     | 4                    | 4.54   | 4.32   | 4.19   | 4.11   | 4.05   | 4.01   | 3.98   | 3.95   | 3.93   | 3.92   | 3.90   | 3.87   | 3.84   | 3.82   | 3.79   | 3.78   | 3.76     |
| 0.05     | 4                    | 7.71   | 6.94   | 6.59   | 6.39   | 6.26   | 6.16   | 6.09   | 6.04   | 6.00   | 5.96   | 5.91   | 5.86   | 5.80   | 5.75   | 5.69   | 5.66   | 5.63     |
| 0.025    | 4                    | 12.2   | 10.6   | 9.98   | 9.60   | 9.36   | 9.20   | 9.07   | 8.98   | 8.90   | 8.84   | 8.75   | 8.66   | 8.56   | 8.46   | 8.36   | 8.31   | 8.26     |
| 0.01     | 4                    | 21.2   | 18.0   | 16.7   | 16.0   | 15.5   | 15.2   | 15.0   | 14.8   | 14.7   | 14.5   | 14.4   | 14.2   | 14.0   | 13.8   | 13.7   | 13.6   | 13.5     |
| 0.005    | 4                    | 31.3   | 26.3   | 24.3   | 23.2   | 22.5   | 22.0   | 21.6   | 21.4   | 21.1   | 21.0   | 20.7   | 20.4   | 20.2   | 19.9   | 19.6   | 19.5   | 19.3     |
| 0.10     | 5                    | 4.06   | 3.78   | 3.62   | 3.52   | 3.45   | 3.40   | 3.37   | 3.34   | 3.32   | 3.30   | 3.27   | 3.24   | 3.21   | 3.17   | 3.14   | 3.12   | 3.11     |
| 0.05     | 5                    | 6.61   | 5.79   | 5.41   | 5.19   | 5.05   | 4.95   | 4.88   | 4.82   | 4.77   | 4.74   | 4.68   | 4.62   | 4.56   | 4.50   | 4.43   | 4.40   | 4.37     |
| 0.025    | 5                    | 10.0   | 8.43   | 7.76   | 7.39   | 7.15   | 6.98   | 6.85   | 6.76   | 6.68   | 6.62   | 6.52   | 6.43   | 6.33   | 6.23   | 6.12   | 6.07   | 6.02     |
| 0.01     | 5                    | 16.3   | 13.3   | 12.1   | 11.4   | 11.0   | 10.7   | 10.5   | 10.3   | 10.2   | 10.1   | 9.89   | 9.72   | 9.55   | 9.38   | 9.20   | 9.11   | 9.02     |
| 0.005    | 5                    | 22.8   | 18.3   | 16.5   | 15.6   | 14.9   | 14.5   | 14.2   | 14.0   | 13.8   | 13.6   | 13.4   | 13.1   | 12.9   | 12.7   | 12.4   | 12.3   | 12.1     |
| 0.10     | 6                    | 3.78   | 3.46   | 3.29   | 3.18   | 3.11   | 3.05   | 3.01   | 2.98   | 2.96   | 2.94   | 2.90   | 2.87   | 2.84   | 2.80   | 2.76   | 2.74   | 2.72     |
| 0.05     | 6                    | 5.99   | 5.14   | 4.76   | 4.53   | 4.39   | 4.28   | 4.21   | 4.15   | 4.10   | 4.06   | 4.00   | 3.94   | 3.87   | 3.81   | 3.74   | 3.70   | 3.67     |
| 0.025    | 6                    | 8.81   | 7.26   | 6.60   | 6.23   | 5.99   | 5.82   | 5.70   | 5.60   | 5.52   | 5.46   | 5.37   | 5.27   | 5.17   | 5.07   | 4.96   | 4.90   | 4.85     |
| 0.01     | 6                    | 13.7   | 10.9   | 9.78   | 9.15   | 8.75   | 8.47   | 8.26   | 8.10   | 7.98   | 7.87   | 7.72   | 7.56   | 7.40   | 7.23   | 7.06   | 6.97   | 6.88     |
| 0.005    | 6                    | 18.6   | 14.5   | 12.9   | 12.0   | 11.5   | 11.1   | 10.8   | 10.6   | 10.4   | 10.2   | 10.0   | 9.81   | 9.59   | 9.36   | 9.12   | 9.00   | 8.88     |
| 0.10     | 7                    | 3.59   | 3.26   | 3.07   | 2.96   | 2.88   | 2.83   | 2.78   | 2.75   | 2.72   | 2.70   | 2.67   | 2.63   | 2.59   | 2.56   | 2.51   | 2.49   | 2.47     |
| 0.05     | 7                    | 5.59   | 4.74   | 4.35   | 4.12   | 3.97   | 3.87   | 3.79   | 3.73   | 3.68   | 3.64   | 3.57   | 3.51   | 3.44   | 3.38   | 3.30   | 3.27   | 3.23     |
| 0.025    | 7                    | 8.07   | 6.54   | 5.89   | 5.52   | 5.29   | 5.12   | 4.99   | 4.90   | 4.82   | 4.76   | 4.67   | 4.57   | 4.47   | 4.36   | 4.25   | 4.20   | 4.14     |
| 0.01     | 7                    | 12.2   | 9.55   | 8.45   | 7.85   | 7.46   | 7.19   | 6.99   | 6.84   | 6.72   | 6.62   | 6.47   | 6.31   | 6.16   | 5.99   | 5.82   | 5.74   | 5.65     |
| 0.005    | 7                    | 16.2   | 12.4   | 10.9   | 10.1   | 9.52   | 9.16   | 8.89   | 8.68   | 8.51   | 8.38   | 8.18   | 7.97   | 7.75   | 7.53   | 7.31   | 7.19   | 7.08     |
| 0.10     | 8                    | 3.46   | 3.11   | 2.92   | 2.81   | 2.73   | 2.67   | 2.62   | 2.59   | 2.56   | 2.54   | 2.50   | 2.46   | 2.42   | 2.38   | 2.34   | 2.31   | 2.29     |
| 0.05     | 8                    | 5.32   | 4.45   | 4.07   | 3.84   | 3.69   | 3.58   | 3.50   | 3.44   | 3.39   | 3.35   | 3.28   | 3.22   | 3.15   | 3.08   | 3.01   | 2.97   | 2.93     |
| 0.025    | 8                    | 7.57   | 6.05   | 5.42   | 5.05   | 4.82   | 4.65   | 4.53   | 4.43   | 4.36   | 4.30   | 4.20   | 4.10   | 4.00   | 3.89   | 3.78   | 3.73   | 3.67     |
| 0.01     | 8                    | 11.3   | 8.65   | 7.59   | 7.01   | 6.63   | 6.37   | 6.18   | 6.03   | 5.91   | 5.81   | 5.67   | 5.52   | 5.36   | 5.20   | 5.03   | 4.95   | 4.86     |
| 0.005    | 8                    | 14.7   | 11.0   | 9.60   | 8.81   | 8.30   | 7.95   | 7.69   | 7.50   | 7.34   | 7.21   | 7.01   | 6.81   | 6.61   | 6.40   | 6.18   | 6.06   | 5.95     |
| 0.10     | 9                    | 3.36   | 3.01   | 2.81   | 2.69   | 2.61   | 2.55   | 2.51   | 2.47   | 2.44   | 2.42   | 2.38   | 2.34   | 2.30   | 2.25   | 2.21   | 2.18   | 2.16     |
| 0.05     | 9                    | 5.12   | 4.26   | 3.86   | 3.63   | 3.48   | 3.37   | 3.29   | 3.23   | 3.18   | 3.14   | 3.07   | 3.01   | 2.94   | 2.86   | 2.79   | 2.75   | 2.71     |
| 0.025    | 9                    | 7.21   | 5.71   | 5.08   | 4.72   | 4.48   | 4.32   | 4.20   | 4.10   | 4.03   | 3.96   | 3.87   | 3.77   | 3.67   | 3.56   | 3.45   | 3.39   | 3.33     |
| 0.01     | 9                    | 10.6   | 8.02   | 6.99   | 6.42   | 6.06   | 5.80   | 5.61   | 5.47   | 5.35   | 5.26   | 5.11   | 4.96   | 4.81   | 4.65   | 4.48   | 4.40   | 4.31     |
| 0.005    | 9                    | 13.6   | 10.1   | 8.72   | 7.96   | 7.47   | 7.13   | 6.88   | 6.69   | 6.54   | 6.43   | 6.23   | 6.03   | 5.83   | 5.62   | 5.41   | 5.30   | 5.19     |
| 0.10     | 10                   | 3.29   | 2.92   | 2.73   | 2.61   | 2.52   | 2.46   | 2.41   | 2.38   | 2.35   | 2.32   | 2.28   | 2.24   | 2.20   | 2.15   | 2.11   | 2.08   | 2.06     |
| 0.05     | 10                   | 4.96   | 4.10   | 3.71   | 3.48   | 3.33   | 3.22   | 3.14   | 3.07   | 3.02   | 2.98   | 2.91   | 2.84   | 2.77   | 2.70   | 2.62   | 2.58   | 2.54     |
| 0.025    | 10                   | 6.94   | 5.46   | 4.83   | 4.47   | 4.24   | 4.07   | 3.95   | 3.85   | 3.78   | 3.72   | 3.62   | 3.52   | 3.42   | 3.31   | 3.20   | 3.14   | 3.08     |
| 0.01     | 10                   | 10.0   | 7.56   | 6.55   | 5.99   | 5.64   | 5.39   | 5.20   | 5.06   | 4.94   | 4.85   | 4.71   | 4.56   | 4.41   | 4.25   | 4.08   | 4.00   | 3.91     |
| 0.005    | 10                   | 12.8   | 9.43   | 8.08   | 7.34   | 6.87   | 6.54   | 6.30   | 6.12   | 5.97   | 5.85   | 5.66   | 5.47   | 5.27   | 5.07   | 4.86   | 4.75   | 4.64     |
| 0.10     | 12                   | 3.18   | 2.81   | 2.61   | 2.48   | 2.39   | 2.33   | 2.28   | 2.24   | 2.21   | 2.19   | 2.15   | 2.10   | 2.06   | 2.01   | 1.96   | 1.93   | 1.90     |
| 0.05     | 12                   | 4.75   | 3.89   | 3.49   | 3.26   | 3.11   | 3.00   | 2.91   | 2.85   | 2.80   | 2.75   | 2.69   | 2.62   | 2.54   | 2.47   | 2.38   | 2.34   | 2.30     |
| 0.025    | 12                   | 6.55   | 5.10   | 4.47   | 4.12   | 3.89   | 3.73   | 3.61   | 3.51   | 3.44   | 3.37   | 3.28   | 3.18   | 3.07   | 2.96   | 2.85   | 2.79   | 2.72     |
| 0.01     | 12                   | 9.33   | 6.93   | 5.95   | 5.41   | 5.06   | 4.82   | 4.64   | 4.50   | 4.39   | 4.30   | 4.16   | 4.01   | 3.86   | 3.70   | 3.54   | 3.45   | 3.36     |
| 0.005    | 12                   | 11.8   | 8.51   | 7.23   | 6.52   | 6.07   | 5.76   | 5.52   | 5.35   | 5.20   | 5.09   | 4.91   | 4.72   | 4.53   | 4.33   | 4.12   | 4.01   | 3.90     |
| 0.10     | 15                   | 3.07   | 2.70   | 2.49   | 2.36   | 2.27   | 2.21   | 2.16   | 2.12   | 2.09   | 2.06   | 2.02   | 1.97   | 1.92   | 1.87   | 1.82   | 1.79   | 1.76     |
| 0.05     | 15                   | 4.54   | 3.68   | 3.29   | 3.06   | 2.90   | 2.79   | 2.71   | 2.64   | 2.59   | 2.54   | 2.48   | 2.40   | 2.33   | 2.25   | 2.16   | 2.11   | 2.07     |
| 0.025    | 15                   | 6.20   | 4.77   | 4.15   | 3.80   | 3.58   | 3.41   | 3.29   | 3.20   | 3.12   | 3.06   | 2.96   | 2.86   | 2.76   | 2.64   | 2.52   | 2.46   | 2.40     |
| 0.01     | 15                   | 8.68   | 6.36   | 5.42   | 4.89   | 4.56   | 4.32   | 4.14   | 4.00   | 3.89   | 3.80   | 3.67   | 3.52   | 3.37   | 3.21   | 3.05   | 2.96   | 2.87     |
| 0.005    | 15                   | 10.8   | 7.70   | 6.48   | 5.80   | 5.37   | 5.07   | 4.85   | 4.67   | 4.54   | 4.42   | 4.25   | 4.07   | 3.88   | 3.69   | 3.48   | 3.37   | 3.26     |
| 0.10     | 20                   | 2.97   | 2.59   | 2.38   | 2.25   | 2.16   | 2.09   | 2.04   | 2.00   | 1.96   | 1.94   | 1.89   | 1.84   | 1.79   | 1.74   | 1.68   | 1.64   | 1.61     |
| 0.05     | 20                   | 4.35   | 3.49   | 3.10   | 2.87   | 2.71   | 2.60   | 2.51   | 2.45   | 2.39   | 2      |        |        |        |        |        |        |          |