

AP Statistics

Module 6 Free Response and Essay Tips

There are LOTS of resources out there to help you develop your Free Response Essays. Here are a few of our main guidelines:

- Always include the formula
- Always include what each variable represents
- Always include the values you are going to use for each variable
- Always include the work you are doing with the formula and values
- Never round calculations until the very end.
- Always support your final answer with your calculations and vocabulary.
- Always clearly state your conclusion to the question asked.

Below you will find a breakdown of different AP topics for this module. The sections include expectations for answering questions over each topic and examples of how these areas should be handled:

BASICS FOR Z TESTS AND Z CONFIDENCE INTERVALS

Actual AP Exam Expectations	Notes
1. Define symbols appropriately	Incorrect: $\mu = 75$ Correct: $\mu = 75$, where μ is the mean of the reading test scores for all students in this school
2. Use precise terminology	Incorrect: "the mean" Correct: μ represents "the population mean" or \bar{x} represents "the sample mean"
3. Verify all conditions	SRS, normality, independence If $n < 30$ or the sample is not stated as a SRS, <u>we must say</u> that we proceed with caution.
4. Represent graphs completely	All axes should be labeled with the specific category/information they represent. Graph should always have a title. The desired portion of the graph should be shaded.
5. Save rounding for the last step	It is best not to round numbers at intermediate steps in a calculation. Wait until the end to round and then do not round too much. Do not use less than 4 places after the decimal at all times. The more you round, the more incorrect your answer becomes.

6. Include graphs when they are necessary	Graphs should be included when data is given, not the statistics, and/or you are asked to “sketch” the graph. Boxplots are usually easiest – check for outliers and skewedness
7. Use the correct distribution	Use z when you are given the population standard deviation Use t when you are not given the population standard deviation

CONFIDENCE INTERVALS and MARGIN OF ERROR

Actual AP Exam Expectations	Notes
1. SHOW all steps of the confidence interval	1) Parameter "We want to estimate the mean, μ , of <u>context of problem</u> " 2) Conditions *SRS *Normality – If not stated then we must use the CLT if $n > 30$ *Independence – population $> 10n$ Name the interval: One sample z interval 3) Show all work: If you use you the formula, you must do all work by hand and show the steps. If you use the calculator, you must show the test/interval that you selected, ALL inputted information, and ALL output information Sketch the graph if DATA is given 4) Interpret the results in the context of the problem and make a connection to the given information.
2. Interpret the results of the statistical procedure	Conclusions should be given in terms of the context of the question. Confidence Interval: We are _____% confident that the true population mean μ of <u>context</u> will be between <u>lower value</u> and <u>upper value</u>
3. Adjust the equation for sample size	Z interval: $\mu \pm \text{critical value} \left(\frac{\delta}{\sqrt{n}} \right)$
4. Margin of error	Everything after the +/- in the confidence interval This value shows how accurate we believe our guess is and is based on the variability of the estimate
5. Find the z^* for the confidence interval	Using the calculator: Subtract the level of significance from 1. So $1 - \alpha$ and then divide that value by 2. On the calculator DISTR-> INVNORM -> AREA: $((1-\alpha)/2)$ $\mu:0$ $\delta: 1$ -> ENTER This will give you the

	critical value z^*
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- The Margin of error decreases when: z^* or t^* decrease, confidence level decreases, population standard deviation (δ) gets smaller, sample size (n) increases
- Increasing the sample size decreases the width of a confidence interval.
- Here is a video specific to this topic. It includes examples and how to be most successful on the AP exam for the topic.

6.01-6.03: Confidence Intervals and Margin of Errors

<https://sas.illuminate.com/p.inlp?psid=2014-12-29.1731.M.02B50E368656D296A2DCBFED1F5B9E.vcr&sid=679>

TESTS OF SIGNIFICANCE

<p>1. SHOW all steps of the test or confidence interval</p>	<ol style="list-style-type: none"> 1) Parameter "We want to estimate the mean, μ, of <u>context of problem</u> " 2) Conditions <ul style="list-style-type: none"> *SRS *Normality – If not stated then we must use the CLT if $n > 30$ *Independence – population $> 10n$ <p>Name the test: One sample z test</p> <ol style="list-style-type: none"> 3) State the null (H_0) and alternative hypotheses (H_a) in context. 4) Show all work: If you use you the formula, you must do all work by hand and show the steps. If you use the calculator, you must show the test/interval that you selected, ALL inputted information, and ALL output information Sketch the graph if DATA is given 5) Interpret the results in the context of the problem and make a connection to the given information.
<p>2. Interpret the results of a statistical procedure</p>	<p>Conclusions should be given in terms of the context of the question.</p> <p>Test of Significance: Reject or Fail to reject the null hypothesis that <u>context of the problem</u> because the p-value is $< > \neq$ level of significance. There is/is not sufficient evidence to suggest that <u>restate the null hypothesis</u>.</p>
<p>3. Adjust the equation for sample size</p>	<p>Z test: $\frac{\bar{x} - \mu}{\frac{\delta}{\sqrt{n}}}$</p>

- **P-value:** The probability of seeing a result from a random sample that is as extreme as or more extreme than the result you got from your random sample, if the null hypothesis is true.

- **Errors:** Type 1 error: rejecting H_0 , when it is true
Type 2 error: failing to reject H_0 , when it is false

If H_0 is true, the probability of a Type 1 error = α

The power of a test is the probability of correctly rejecting the H_0

- Increasing the sample size decreases the p-value of the test (making the rejection of the null more convincing). As n increases, so does the power of the test.
- Here are some videos specific to this topic. They include examples and how to be most successful on the AP exam for the topic

6.04-6.05: Intro to Inference and Significance Tests

<https://sas.illuminate.com/p.inlp?psid=2015-01-14.0718.M.02B50E368656D296A2DCBFED1F5B9E.vcr&sid=679>

6.06, 6.07, 6.09: Carrying Out Significance Tests/Connecting Confidence Intervals to Significance Tests

****STEP BY STEP PROCEDURES TO KNOW FOR AP EXAM**

<https://sas.illuminate.com/p.inlp?psid=2015-01-14.0739.M.02B50E368656D296A2DCBFED1F5B9E.vcr&sid=679>

6.08: Using Inference to make decisions: Type I and II Errors

<https://sas.illuminate.com/p.inlp?psid=2015-01-14.0842.M.02B50E368656D296A2DCBFED1F5B9E.vcr&sid=679>

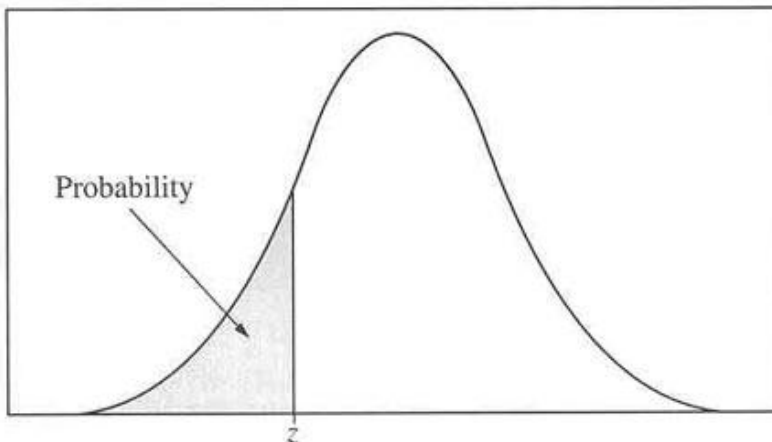


Table entry for z is the probability lying below z .

Table A Standard normal probabilities

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

