Two-Sample t-Test: exam practice

10 questions · 38 marks · worked solutions and markschemes

Name _____ Date _____ Score / 38

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/slai/two-sample-t-test-exam-practice

1. **3 marks · Paper 2 style · calculator allowed**

The number of sit-ups in one minute for two groups of students are shown. Test at the 5% level whether group A has the higher mean. Assume normal populations with equal variances.

Group A	31	35	29	33	36	32
Group B	28	30	27	31	29	26

Find the p-value and state the conclusion. **[3]**

2. **3 marks · Paper 1 style · calculator allowed**

A two-sample t-test compares the mean battery life of two brands of phone. The hypotheses are $H_0 : \mu_1 = \mu_2$ and $H_1 : \mu_1 \neq \mu_2$, and the p-value is 0.083.

(a) State whether this is a one-tailed or a two-tailed test. **[1]**

(b) State the conclusion at the 10% level and at the 5% level. **[2]**

3. **3 marks · Paper 2 style · calculator allowed**

The masses, in kg, of five parcels from each of two depots are shown. Test at the 5% level whether the mean masses differ. Assume normal populations with equal variances.

Depot 1	4.1	3.8	4.5	4.0	4.3
Depot 2	4.2	4.4	3.9	4.1	4.6

(a) Find the p-value. **[2]**

(b) State the conclusion. **[1]**

4. **3 marks · Paper 2 style · calculator allowed**

Reaction times, in seconds, of two groups are shown. Test at the 5% level whether the mean reaction times differ. Assume normal populations with equal variances.

Group 1	0.42	0.38	0.45	0.4	0.44	0.39	0.41
Group 2	0.43	0.4	0.44	0.42	0.45	0.41	0.4

(a) Find the p-value. **[2]**

(b) State the conclusion. **[1]**

5. **4 marks · Paper 2 style · calculator allowed**

The masses, in grams, of apples from two orchards are shown. A two-tailed t-test at the 5% level is used to compare the mean masses. Assume the populations are normal with equal variances.

Orchard A	12.1	13.4	11.8	12.9	13.0	12.5
Orchard B	11.2	12.0	11.5	11.9	12.3	11.0

(a) State the hypotheses. **[1]**

(b) Find the p-value. **[2]**

(c) State the conclusion. **[1]**

6. **4 marks · Paper 2 style · calculator allowed**

A gardener tests whether a new feed makes plants grow taller. Heights, in cm, after six weeks are shown. A one-tailed t-test is used at the 5% level. Assume normal populations with equal variances.

New feed	24	27	25	29	26	28	27
No feed	23	24	22	25	24	23	26

(a) State the hypotheses, using μ_N and μ_O. **[1]**

(b) Find the p-value. **[2]**

(c) State the conclusion. **[1]**

7. **4 marks · Paper 2 style · calculator allowed**

A coach tests whether players who skip warm-ups score lower on a fitness test. Scores are shown. Use a one-tailed t-test at the 5% level, assuming normal populations with equal variances.

No warm-up	52	48	55	50	47	53
Warm-up	58	55	60	54	57	59

(a) State the hypotheses, using μ_N and μ_W. **[1]**

(b) Find the p-value and state the conclusion. **[3]**

8. **4 marks · Paper 2 style · calculator allowed**

A researcher compares the heights, in cm, of two groups of seedlings.

Group 1	150	162	158	149	165	155	160
Group 2	148	152	150	155	147	151	149

(a) Explain why a t-test is suitable here rather than a χ^2 test. **[1]**

(b) Using a two-tailed test, find the p-value. Assume normal populations with equal variances. **[2]**

(c) State the conclusion at the 5% level. **[1]**

9. **5 marks · Paper 2 style · calculator allowed**

Test scores of two classes taught with different methods are shown. A teacher tests, at the 1% level, whether method X gives a higher mean score than method Y. Assume normal populations with equal variances.

Method X	68	72	75	70	74	69	71
Method Y	65	70	66	68	64	67	69

(a) Find the mean of each sample. **[2]**

(b) Find the p-value and state the conclusion. **[3]**

10. **5 marks · Paper 2 style · calculator allowed**

The pH of water samples from two lakes is shown. Assume normal populations with equal variances.

Lake P	7.2	6.8	7.5	7.1	6.9	7.4	7.0	7.3
Lake Q	6.9	6.6	7.1	6.8	7.0	6.7	6.9	6.5

(a) Find the mean pH for each lake. **[2]**

(b) Use a two-tailed test to find the p-value. **[2]**

(c) State the conclusion at the 1% level. **[1]**

Answers and worked solutions

Question 1

3 marks

Answer: $p = 0.00474$; reject H_0

one-tailed pooled t–test **(M1)**

$p = 0.00474$ **A1**

$p < 0.05$: reject H_0; group A has the higher mean **R1**

Question 2

3 marks

Answer: (a) two-tailed

(a)

two-tailed **A1**

(b)

10%: reject H_0 **A1**

5%: do not reject H_0 **A1**

Question 3

3 marks

Answer: (a) $p = 0.575$

(a)

two-tailed pooled t–test **(M1)**

$p = 0.575$ **A1**

(b)

$0.575 > 0.05$: do not reject H_0 **R1**

Question 4

3 marks

Answer: (a) $p = 0.495$

(a)

two-tailed pooled t–test **(M1)**

$p = 0.495$ **A1**

(b)

$0.495 > 0.05$: do not reject H_0; no evidence of a difference **R1**

Question 5

4 marks

Answer: (b) $p = 0.0126$

(a)

$H_0 : \mu_A = \mu_B$, $H_1 : \mu_A \neq \mu_B$ **A1**

(b)

pooled t–test **(M1)**

$p = 0.0126$ **A1**

(c)

$0.0126 < 0.05$: reject H_0; the mean masses differ **R1**

Question 6

4 marks

Answer: (b) $p = 0.00322$

(a)

$H_0 : \mu_N = \mu_O$, $H_1 : \mu_N > \mu_O$ **A1**

(b)

one-tailed pooled t–test **(M1)**

$p = 0.00322$ **A1**

(c)

$p < 0.05$: reject H_0; the new feed gives taller plants on average **R1**

Question 7

4 marks

Answer: (b) $p = 0.00118$; reject H_0

(a)

$H_0 : \mu_N = \mu_W$,
$H_1 : \mu_N < \mu_W$ **A1**

(b)

one-tailed pooled t–test **(M1)**

$p = 0.00118$ **A1**

$p < 0.05$: reject H_0 **R1**

Question 8

4 marks

Answer: (b) $p = 0.0193$

(a)

the data are measurements, and the test compares two means **R1**

(b)

pooled t–test **(M1)**

$p = 0.0193$ **A1**

(c)

$0.0193 < 0.05$: reject H_0 **R1**

Question 9

5 marks

Answer: (a) 71.3 and 67; (b) $p = 0.00272$; reject H_0

(a)

$\bar{x}_X = 71.3$ **A1**

$\bar{x}_Y = 67$ **A1**

(b)

one-tailed pooled t–test **(M1)**

$p = 0.00272$ **A1**

$p < 0.01$: reject H_0 **R1**

Question 10

5 marks

Answer: (a) 7.15 and 6.81; (b) $p = 0.00955$

(a)

7.15 **A1**

6.81 **A1**

(b)

pooled t–test **(M1)**

$p = 0.00955$ **A1**

(c)

$0.00955 < 0.01$: reject H_0 **R1**

Every solution is also on ibmathrevision.com/slai/two-sample-t-test-exam-practice
Our own original questions, written and checked by IB Math Revision. IB Math Revision is independent and is not affiliated with, endorsed by or connected to the International Baccalaureate Organization. This work/product/service has been developed independently from and is not endorsed by the International Baccalaureate Organization. International Baccalaureate, Baccalauréat International, Bachillerato Internacional and IB are registered trademarks owned by the International Baccalaureate Organization.