6.

Two sample t-test :-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sigma_{\bar{x}}}$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S} \times \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

S = Combined standard deviation

$$S = \sqrt{\frac{\sum(x_1 - \bar{x}_1)^2 + \sum(x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}}$$

degree of freedom = $n_1 + n_2 - 2$

☆ So Here null Hypothesis : H_0 : $\bar{x}_1 = \bar{x}_2$

Alternative Hypothesis : H_a : $\bar{x}_1 \neq \bar{x}_2$
[Two-tail Test]

→ $\bar{x}_1 = \frac{\sum x_1}{n_1}$ → $\bar{x}_2 = \frac{\sum x_2}{n_2}$

$= \frac{231}{10}$ $= \frac{251}{10}$

$= 23.1$ $= 25.1$

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x_1	$(x_1 - \bar{x}_1)$ $(x_1 - 23.1)$	$(x_1 - \bar{x}_1)^2$	x_2	$(x_2 - \bar{x}_2)$ $(x_2 - 25.1)$	$(x_2 - \bar{x}_2)^2$
16	-7.1	50.41	19	-6.1	37.21
20	-3.1	9.61	22	-3.1	9.61
21	-2.1	4.41	24	-1.1	1.21
22	-1.1	1.21	24	-1.1	1.21
23	-0.1	0.01	25	-0.1	0.01
22	-1.1	1.21	25	-0.1	0.01
27	~~-4.1~~ 3.9	15.21	26	0.9	0.81
25	1.9	3.61	26	0.9	0.81
27	3.9	15.21	28	2.9	8.41
28	4.9	24.01	32	6.9	47.61
23.1		124.9	25.1		106.9

124.9

→ Combined Sample SD :-

$$S = \sqrt{\frac{\Sigma(x_1 - \bar{x}_1)^2 + \Sigma(x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}}$$

$$= \sqrt{\frac{124.9 + 106.9}{10 + 10 - 2}}$$

$$= \sqrt{\frac{231.8}{18}}$$

$$= 3.5886$$

$\rightarrow$ $t = \dfrac{\bar{x}_1 - \bar{x}_2}{S} \times \sqrt{\dfrac{n_1 n_2}{n_1 + n_2}}$

$= \dfrac{23.1 - 25.1}{3.5886} \times \sqrt{\dfrac{10 \times 10}{10 + 10}}$

$= \dfrac{-2}{3.5886} \times \sqrt{\dfrac{\cancel{100}^{5}}{\cancel{20}}}$

$= \dfrac{-2}{3.5886} \times 2.2361$

$= -1.246$

$\therefore \boxed{|t| = 1.246}$

$\rightarrow$ degree of freedom $(\nu) = n_1 + n_2 - 2$
$= 10 + 10 - 2$
$= 18$

$\rightarrow$ level of signification $(\alpha) = 0.05$

$\rightarrow$ tabulate t at 18 d.f and $\alpha = 0.05$
for two-tail test. $\boxed{t = 2.101}$

(looked in the t-table)

$\rightarrow$ ~~Calculation~~

$\rightarrow$ Decision :- $|t|_{score} < t_{critical}$
$1.246 < 2.101$
So, null hypothesis will be accepted.

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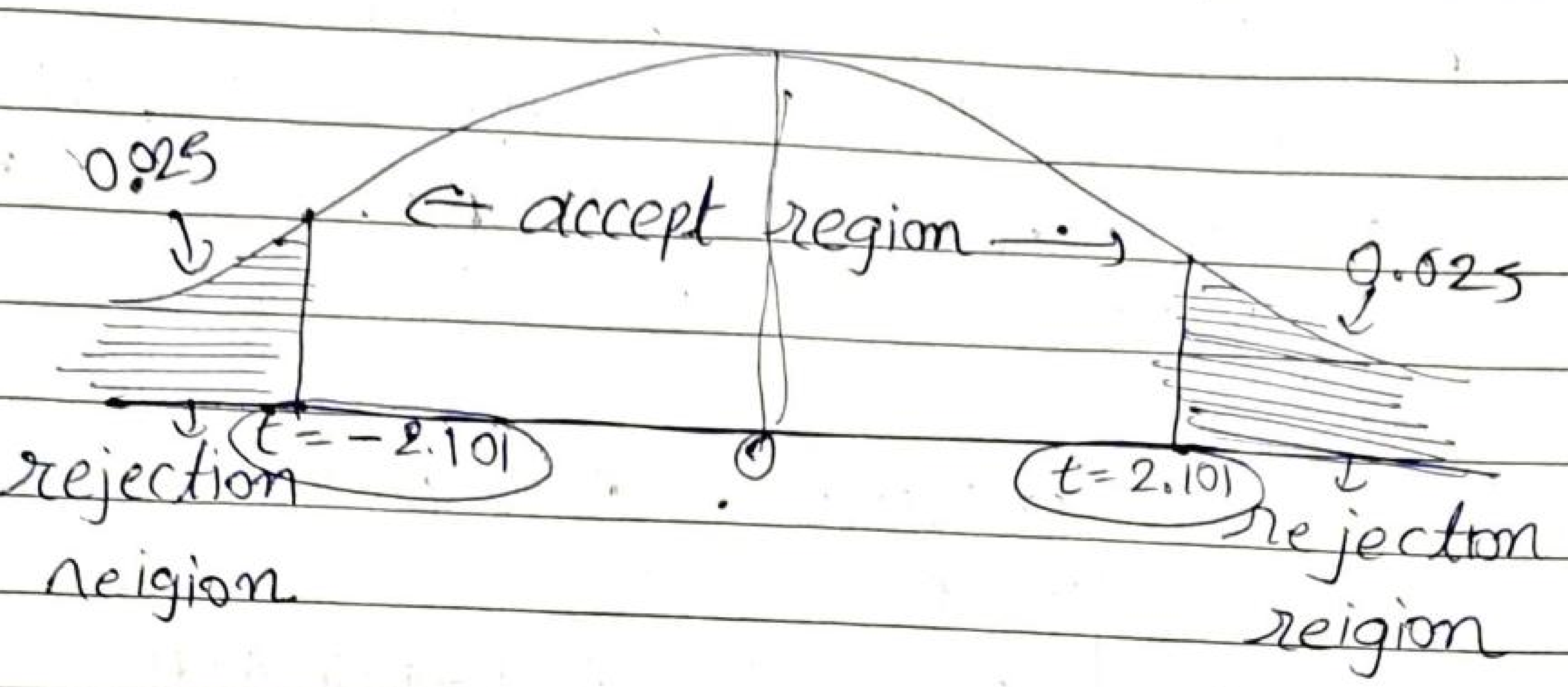
$\alpha = 0.05$



So, Here we will accept the null hypothesis that mean regular gas mileage and premium gas's mileage both are equal.

* p-value:-

tscore = 1.246
d.f = 18
So, p-value is 0.2287 which is greater than α - value which is 0.05 and for two-tail test, $\alpha/2 = 0.025$

p-value (~~0.0228~~ $> \alpha$
0.2287 > 0.05

* Decision:-
There is not enogh evidence to reject Ho (null hypothesis) at the significaton level 0.05, because p-value is greater than 0.05