ELECTRICAL MATHEMATICS
TEST 3 – *TRIAL TEST/ASSIGNMENT*

Notes:

- Test covers graphs/tables, straight line equation, Pythagoras, basic trigonometry & indices.
- The actual test will be closed book, calculator and ruler required.
- It is **ESSENTIAL** to show working/steps, where asked, otherwise **no marks** can be given.

1. From the test results in the table below:

   a. Using graph paper, plot I vs V , including a line of best fit.
   (use the graph paper provided on p.6 to answer this question)

   See p. 6 for solution

   b. From your graph, estimate the current when 7.00 V is applied to the test resistor.

   When V=7V , estimated I = 345 mA

V (V) - applied	0.00	2.00	4.00	6.00	8.00	10.00
I (A) - measured	0.00	0.10	0.21	0.30	0.39	0.49

2. Plot each of the following equations on the **same** set of x-y axes, using the graph paper attached. Clearly identify each plot. (use the graph paper provided on p.7 to answer this question)

   a. $y = 2x + 3$ (2x → gradient; 3 → y-intercept)

   b. $2y + 6x + 4 = 0$

To draw a straight line, we need just two points. For graph a.) M(x=0; y=+3) & N(x=−1½; y=0)

For graph b.) P(x=0; y=−2) & Q(x=−2/3; y=0)

3. Determine the gradient **AND** the x and y-intercepts for **BOTH** of the equations in the previous question.

a.) $y = 2x + 3$, gradient +2, y-intercept +3 (from previous question)

When $y=0$, $0=2x+3$ ∴ $2x=-3$ ∴ $x=-\frac{3}{2}=-1\frac{1}{2}$

So, the y-intercept is $(-1\frac{1}{2})$.

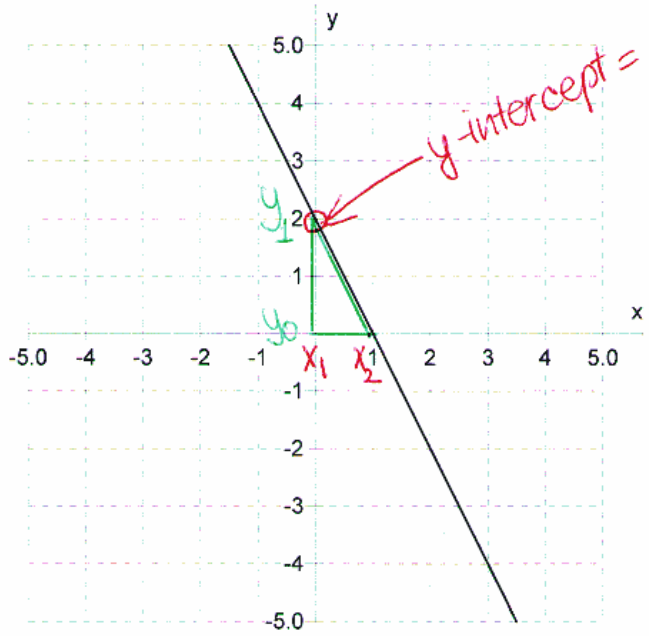
b.) $2y=-6x-4$

$\boxed{y=-3x-2}$, so the gradient is (−3), y-intercept is (−2).

When $y=0$, $0=-3x-2$ ∴ $3x=-2$ ∴ $x=-\frac{2}{3}$

Therefore, the x-intercept is $(-\frac{2}{3})$.

4. Determine the equation of the line in the graph below:



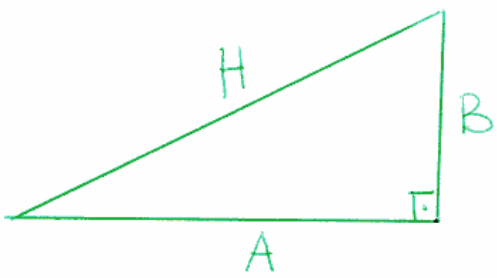
$$\text{Gradient} = \frac{y_1 - y_0}{x_1 - x_2} = \frac{2 - 0}{0 - 1} = -2$$

$\therefore \; y = mx + c$

$$\boxed{y = -2x + 2}$$

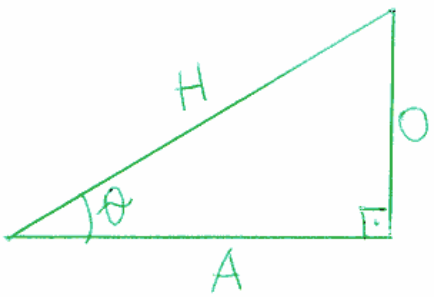
5. Sketch a right-angle triangle, and use it to help state Pythagoras' Theorem.

$$H^2 = A^2 + B^2$$



The hypotenuse squared is equal to the sum of the squares of the other two sides.

6. Draw a right-angled triangle and use it to help define the SINE, COSINE and TANGENT ratios.



H - hypotenuse
A - adjacent side
O - opposite side
θ - the angle in consideration

$\sin\theta = \frac{O}{H}$

$\cos\theta = \frac{A}{H}$

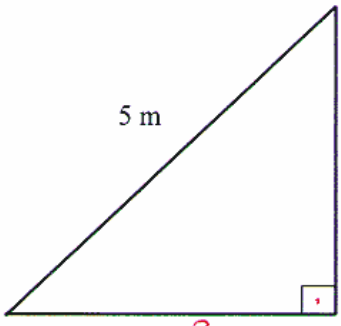
$\tan\theta = \frac{O}{A}$

7. TRUE or FALSE
The SINE and COSINE ratios cannot have values outside the range -1 to +1.

True.

8. Determine the length of the unknown side in each of the triangles below.

a.



$5^2 = x^2 + 4^2$

$x^2 = 5^2 - 4^2$

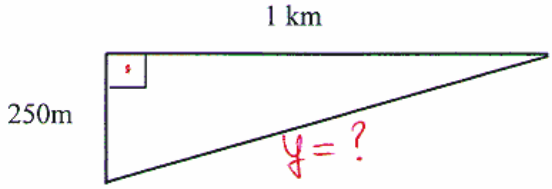
$x^2 = 25 - 16$

$x^2 = 9$

$x = \sqrt{9}$

$x = 3\,m$

b.



$y^2 = 0.25^2 + 1^2$

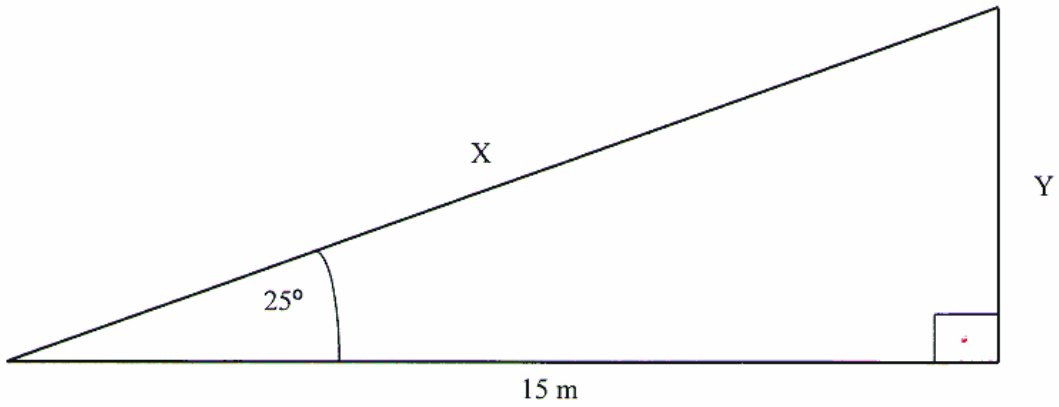
$y^2 = 0.0625 + 1$

$y^2 = 1.0625$

$y = \sqrt{1.0625}$

$y = 1.03\,m$

9. Determine the lengths X **AND** Y in the triangle below, using **only** trigonometry:



$X = \frac{15}{\cos 25°}$

$X = \frac{15}{0.906}$

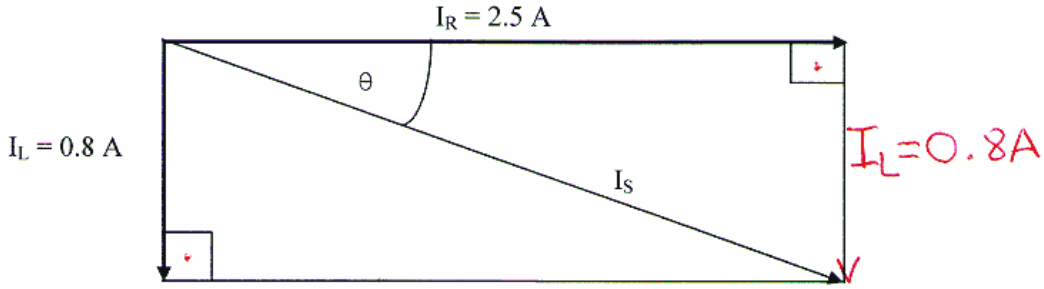
$X = 16.55\,m$

$Y = 15 \times \tan 25°$

$Y = 15 \times 0.466$

$Y = 6.99\,m$

10. Calculate I_S and θ in the phasor diagram below:



$I_S^2 = I_R^2 + I_L^2$

$I_S^2 = 2.5^2 + 0.8^2$

$I_S^2 = 6.25 + 0.64$

$I_S^2 = 6.89$

$I_S = \sqrt{6.89} = 2.62\,A$

$\tan\theta = \frac{I_L}{I_R}$

$\tan\theta = \frac{0.8}{2.5} = 0.32$

$\theta = \tan^{-1}(0.32)$

$\theta = 17.74°$

11. Evaluate the following:

a. $8^{\frac{2}{3}} = \left(\sqrt[3]{8}\right)^2 = (2)^2 = 4$

b. $9^{-\frac{1}{2}} = \frac{1}{9^{\frac{1}{2}}} = \frac{1}{\sqrt{9}} = \frac{1}{3}$

c. $\sqrt[4]{625} = \sqrt[4]{5^4} = 5$

d. $\left(\frac{\left(10^{\frac{1}{2}} \times 5^{\frac{1}{5}}\right)^5}{25^{\frac{3}{2}}}\right)^0 = 1$ Any expression raised to the power of 0 is equal to 1.

12. Simplify, expressing the answer with **positive** indices only:

a. $x^{-4} \div x^{-7}$

$\frac{x^{-4}}{x^{-7}} = x^{[-4-(-7)]} = x^{(-4+7)} = x^3$

b. $\frac{16a^2b^3c^{-1}}{2a^{-3}b^2c^4} = 8a^{[2-(-3)]}b^{(3-2)}c^{(-1-4)} = 8a^5b^1c^{-5} = \frac{8a^5b}{c^5}$

c. $\left(3x^5y^3\right)^{-2}\left(2x^4y\right)^2$

$\frac{(2x^4y)^2}{(3x^5y^3)^2} = \frac{4x^8y^2}{9x^{10}y^6} = \frac{4}{x^2y^4}$

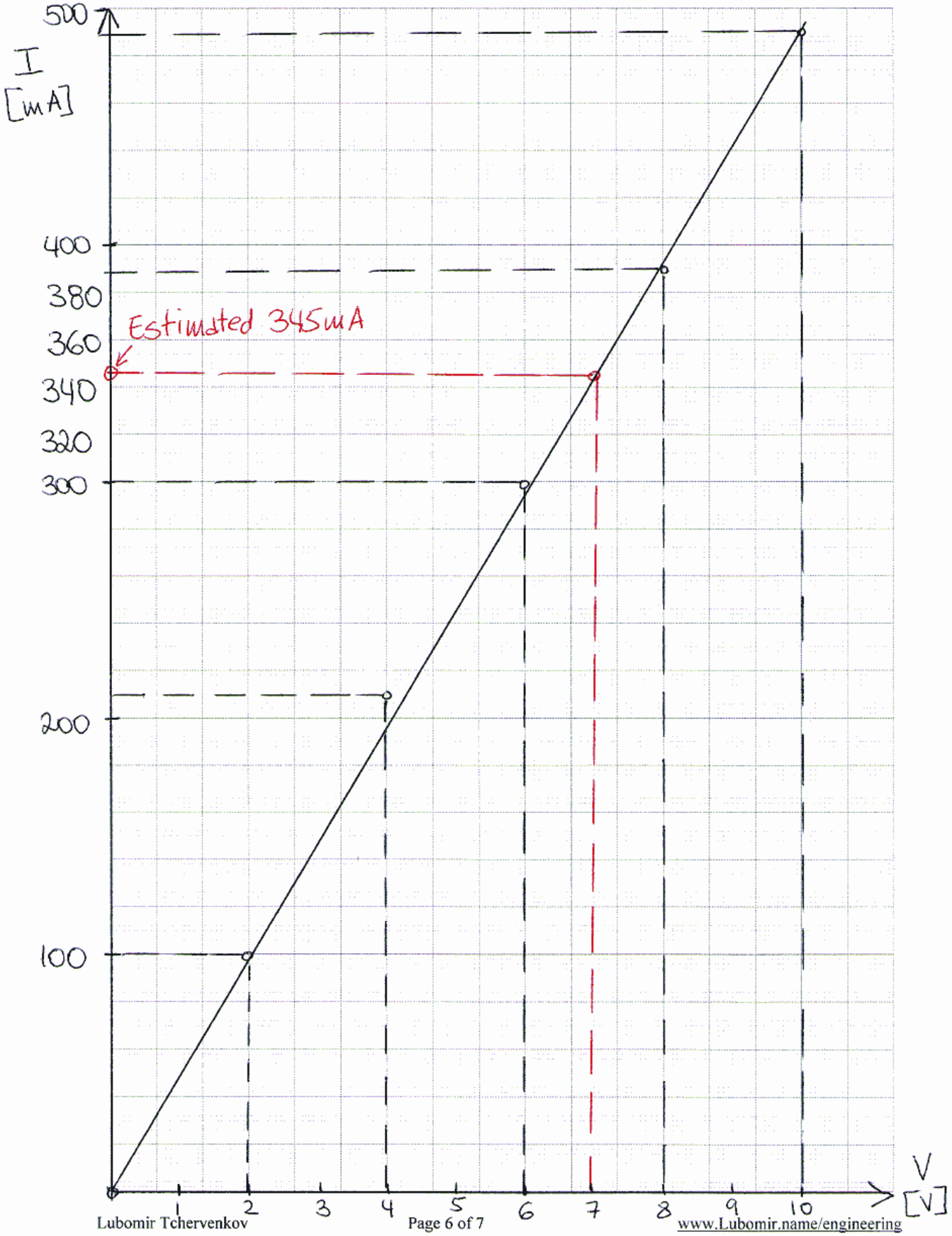
13. Evaluate:

a. $\sqrt[5]{32x^5y^{10}}\,x^2y = (32x^5y^{10})^{\frac{1}{5}}x^2y = 32^{\frac{1}{5}}x^{\frac{5}{5}}y^{\frac{10}{5}}x^2y = (2^5)^{\frac{1}{5}}xy^2x^2y = 2x^3y^3$

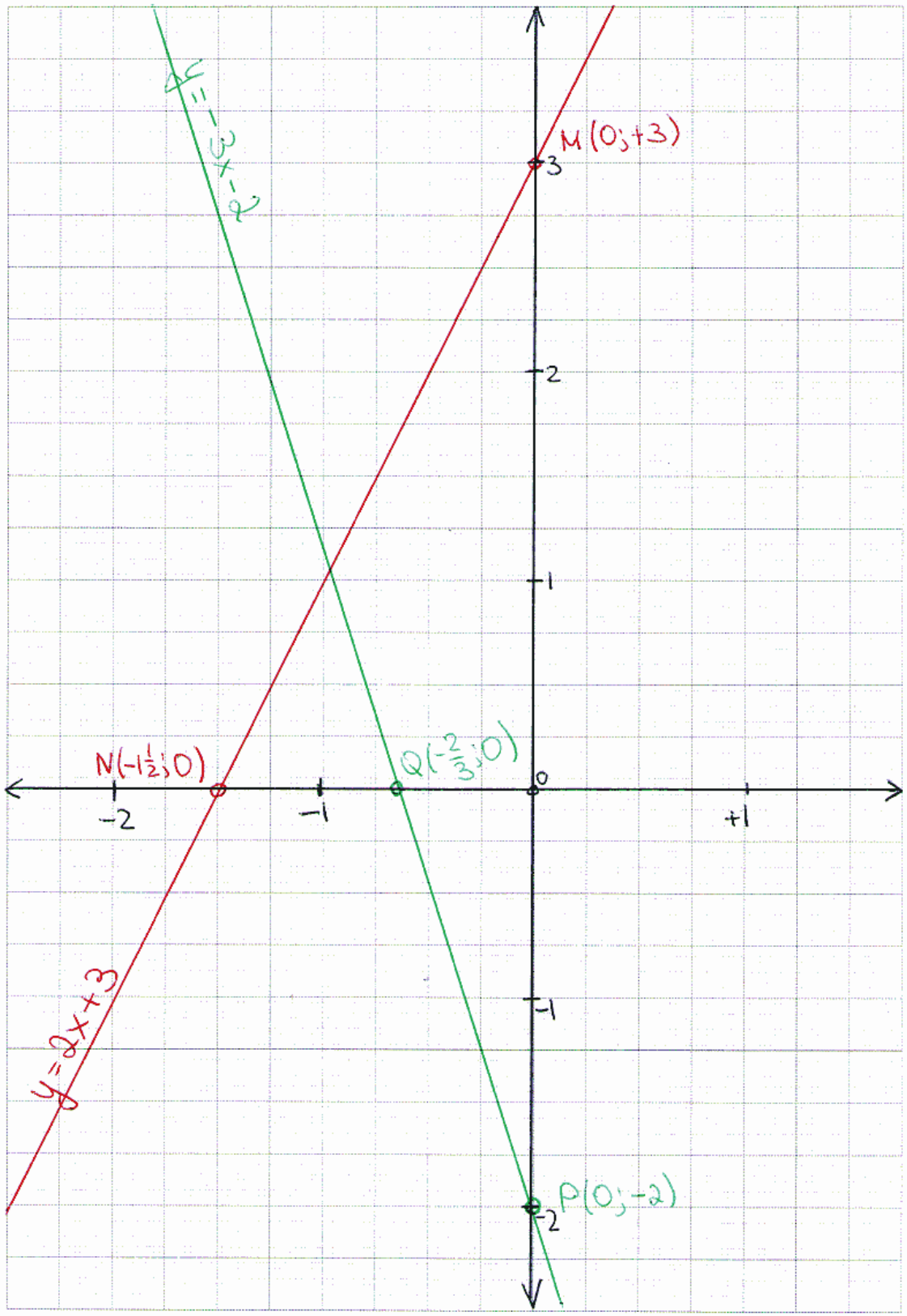
b. $27^{\frac{2}{3}} = \left(\sqrt[3]{27}\right)^2 = \left(\sqrt[3]{3^3}\right)^2 = 3^2 = 9$

c. $16^{-\frac{1}{4}} = \frac{1}{16^{\frac{1}{4}}} = \frac{1}{\sqrt[4]{16}} = \frac{1}{\sqrt[4]{2^4}} = \frac{1}{2}$

Question 1 answer.



Question 2 answer.



------- **END OF TRIAL TEST/ASSIGNMENT** - ***Check your work!*** -------