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PURE MATH

ALGEBRA AND FUNCTION

Level & Board	EDEXCEL (A-LEVEL)
TOPIC:	LINEAR MODAL
PAPER TYPE:	SOLUTION - 1
TOTAL QUESTIONS	8
TOTAL MARKS	44

Q1.

For part (a)

We have been provided with two data points, where the height of a tree is represented as 'H' in meters, and the time since planting is represented as 't' in years.

The data points are as follows:

1. The height of the tree was 2.35 meters at 3 years (H=2.35, t=3).
2. The height of the tree was 3.28 meters at 6 years (H=3.28, t=6).

To determine the equation of the linear model, we will use the point-slope form of a linear equation:

$$(H - H1) = m (t - t1)$$

Here, (t1, H1) is a point on the line, and 'm' is the slope. By using the first data point (t1=3, H1=2.35), we can determine the slope 'm' as follows:

$$m = (H - 2.35) / (t - 3)$$

Next, we will substitute the second data point (t=6, H=3.28) into the equation:

$$3.28 - 2.35 = m (6 - 3)$$

Solving for 'm', we get:

$$m = 0.31$$

Now, we can write the equation in point-slope form by using the slope and any point on the line. Let's use the point (3, 2.35):

$$(H - 2.35) = 0.31 (t - 3)$$

Finally, we can simplify the equation and write it in slope-intercept form:

$$H = 0.31t - 0.28$$

For part (b)

we are given that the height of the tree was approximately 140 cm when it was planted ($t=0$). To check if this fact supports the use of the linear model, we substitute $t=0$ into the equation:

$$H = 0.31(0) - 0.28$$

This gives us a height of -0.28 meters, which is not close to 140 cm. Therefore, the linear model may not be the best fit for the given data.

Q2.

For part (a)

The data points are as follows:

First Data Point: $x=2$, $y=1.5$, $t=2$, $H=1.5$

Second Data Point: $x=5$, $y=4$, $t=5$, $H=4$

To find the equation of the line that passes through these two points, we can use the point-slope form of the linear equation:

$(y - y1) = m(x - x1)$, where m is the slope of the line, and $(x1, y1)$ is a point on the line.

Using the first data point $(x1, y1) = (2, 1.5)$, we can find the slope m:

$$m = (y - 1.5) / (x - 2)$$

Now, substituting the second data point $(x, y) = (5, 4)$ into the equation,

we get:

$$4 - 1.5 = m(5 - 2)$$

Solving for m, we get:

$$m = (4 - 1.5) / (5 - 2)$$

Once we find m, we can use it to write the equation in point-slope form:

$(y - 1.5) = m(x - 2)$

Now, if needed, we can simplify and express it in slope-intercept form

$(y = mx + b)$.

For part (b)

we can check if the model fits the fact that the tree's height was approximately 0.5 meters when it was planted ($t = 0$). Substituting $t = 0$ into the equation, we get:

$H = m(0 - 2) + 1.5$

If the result is close to 0.5 meters, it supports the use of the linear model. If there is a significant difference, it suggests that the linear model may not be the best fit for the given data.

Q3.

For part (a)

We can use the given data to create a linear model.

The first data point is when $t=4$ and $H=30$.

The second data point is when $t=10$ and $H=65$.

We can use the point-slope form of a linear equation to find the slope m.

The point-slope form of a linear equation is:

$(y-y1)=m(x-x1)$,

where $(x1,y1)$ is a point on the line. Using the first data point $(4,30)$, we can find the slope m.

The slope is $m=(H2-H1)/(t2-t1)=(65-30)/(10-4)=5$.

The equation of the line in point-slope form is: $(y-30)=5(x-4)$.

We can simplify this to slope-intercept form, $y=5x+10$, if needed.

For part (b)

we need to check if the model fits the fact that the plant's height was approximately 10 centimeters when it was planted, which means $t=0$.

We can substitute $t=0$ into the equation to get $H=5(0)+10=10$.

Since the result is close to 10 centimeters, it supports the use of the linear model.

If there is a significant difference between the predicted value and the actual value, it suggests that the linear model may not be the best fit for the given data.

Q4.

We have two data points that we can use to create a linear model. The first data point is when the car was two years old and its value was \$18,000. The second data point is when the car was five years old and its value was \$12,000.

To create a linear model, we'll use the point-slope form of a linear equation, which is:

$$V - V1 = m(t - t1)$$

In this equation, $(t1,V1)$ represents a point on the line, and m is the slope.

Using the first data point, which is (2,18), we can find the slope m by using the formula:

$$m = (V - V1) / (t - t1)$$

Next, we substitute the second data point, which is (5,12), into the equation:

$$12 - 18 = m(5 - 2)$$

We solve for m and find that:

$$m = (5 - 2) / (12 - 18)$$

Now we can write the equation in point-slope form, which is:

$$V - 18 = m(t - 2)$$

If needed, we can simplify this equation and express it in slope-intercept form (y=mx+b).

For part (b)

we need to check if the model fits the fact that the car's value was approximately $24,000 when it was new (t=0). To do this, we substitute t=0 into the equation:

$$V = m(0 - 2) + 18$$

If the result is close to $24,000, it supports the use of the linear model. If there is a significant difference, it suggests that the linear model may not be the best fit for the given data.

Q5.

For part (a)

We have two data points, which we can use to create a linear model.

The first data point is interpreted as 5 kilometers, where the time (t) is 10 seconds and the altitude (A) is 10 meters.

The second data point is interpreted as 20 kilometers, where the time (t) is 30 seconds and the altitude (A) is 20 meters.

To create a linear equation, we can use the point-slope form. This is given by:

(A - A1) = m(t - t1), where (t1, A1) is a point on the line, and m is the slope.

Using the first data point (10,5), we can find the slope (m):

$$m = (A - A1)/(t - t1) = (5-10)/(10-10) = -5/0$$

We can't divide by 0, so we need to find another point on the line. Using the second data point (30,20), we can solve for m:

$$m = (A - A1)/(t - t1) = (20-5)/(30-10) = 15/20 = 3/4$$

Now that we have m, we can write the equation in point-slope form:

$$(A - 5) = (3/4)(t - 10)$$

Finally, we simplify and express it in slope-intercept form (y = mx + c):

$$A= (3/4)t - 5/2$$

For part (b)

we need to check if the linear model fits the fact that the rocket's altitude was approximately 0 kilometers at the time of launch (t = 0). We can substitute t = 0 into the equation:

$$A = (3/4)(0) - 5/2 = -5/2$$

Since the result is not close to 0 kilometers, it suggests that the linear model may not be the best fit for the given data.

Q6.

(a)

Finding the value of "n"

We can find the slope of line 3 (l3) by looking at the coefficient of "x" in the equation when it's in the form y=mx+c. Let's rearrange the equation for line 3 to find its slope:

$3x - 2y + 5 = 0$

$-2y = -3x - 5$

$y = 3/2x + 5/2$

Now, let's compare this with the equation for line 4 (l4), $y = nx - 2$. The slope of line 3 is 3/2, so for line 4, the slope "n" must be the negative reciprocal of 3/2, which is -2/3. Therefore, $n = -2/3$.

(b)

Finding the x-coordinate of point "Q"

Let's find the point of intersection Q by solving the system of equations formed by lines 3 and 4:

$3x - 2y + 5 = 0$

$y = -2/3x + 2$

Substitute the expression for y from the second equation into the first:

$3x - 2(-2/3x + 2) + 5 = 0$

Now, solve for x:

$3x + (4/3)x + 13/3 = 0$

$13x = -13$

$x = -1$

So, the x-coordinate of point Q is -1.

Q7.

(a)

Finding the value of "p"

To find the slope of line "5", we can rearrange the equation to the form

$y = mx + c$ where "m" is the coefficient of "x". Thus, for the equation of line "5":

$4x + 3y - 6 = 0$

$3y = -4x + 6$

$y = (-4/3)x + 2$

Now, we can compare this with the equation for line "6",

which is $y = px + 2$. We know that the slope of line "5" is -4/3, so the slope of line "6" must be the negative reciprocal of -4/3, which is 3/4.

Therefore, $p = 3/4$.

(b)

Finding the x-coordinate of point "R"

To find the point of intersection "R", we can solve the system of equations formed by line "5" and line "6":

$4x + 3y - 6 = 0$

$y = (3/4)x + 2$

Substitute the expression for "y" from the second equation into the first:

$4x + 3((3/4)x + 2) - 6 = 0$

Now, solve for "x":

$4x + (9/4)x + 6 - 6 = 0$

$(16/4)x + (9/4)x = 0$

$25/4\ x = 0$

$x = 0$

Thus, the x-coordinate of point "R" is 0.

I am Sorry !!!!!

Q8.

(a)

Finding the value of "p"

To find the slope of "5l5", we can rearrange the equation to the form $y=mx+c$ where "m" is the coefficient of "x". Thus, for the equation of "5l5":

$4x + 3y - 6 = 0$

$3y = -4x + 6$

$y = (-4/3)x + 2$

Now, we can compare this with the equation for "6l6", which is $y = px + 2$. We know that the slope of "5l5" is -4/3, so the slope of "6l6" must be the negative reciprocal of -4/3, which is 3/4. Therefore, $p = 3/4$.

(b)

Finding the x-coordinate of point "R"

To find the point of intersection "R", we can solve the system of equations formed by "5l5" and "6l6":

$4x + 3y - 6 = 0$

$y = (3/4)x + 2$

Substitute the expression for "y" from the second equation into the first:

$4x + 3((3/4)x + 2) - 6 = 0$

Now, solve for "x":

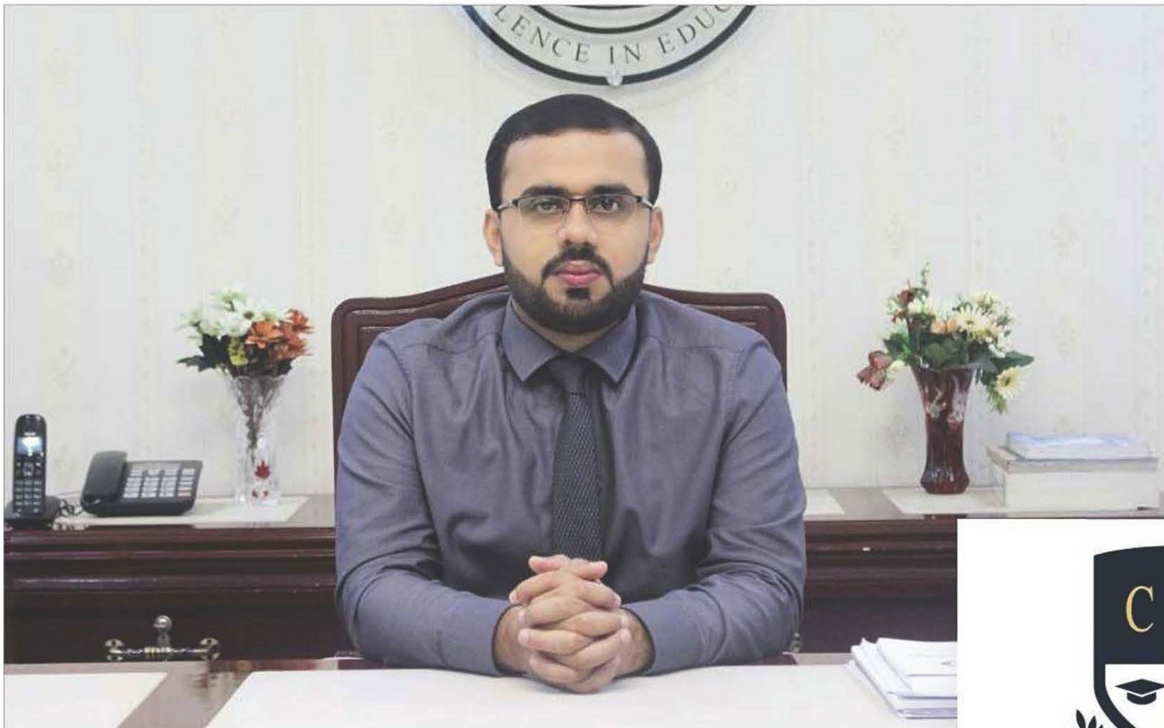
$4x + (9/4)x + 6 - 6 = 0$

$(16/4)x + (9/4)x = 0$

$25/4\ x = 0$

$x = 0$

Thus, the x-coordinate of point "R" is 0.



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