I will comment on communication in orange or in orange boxes

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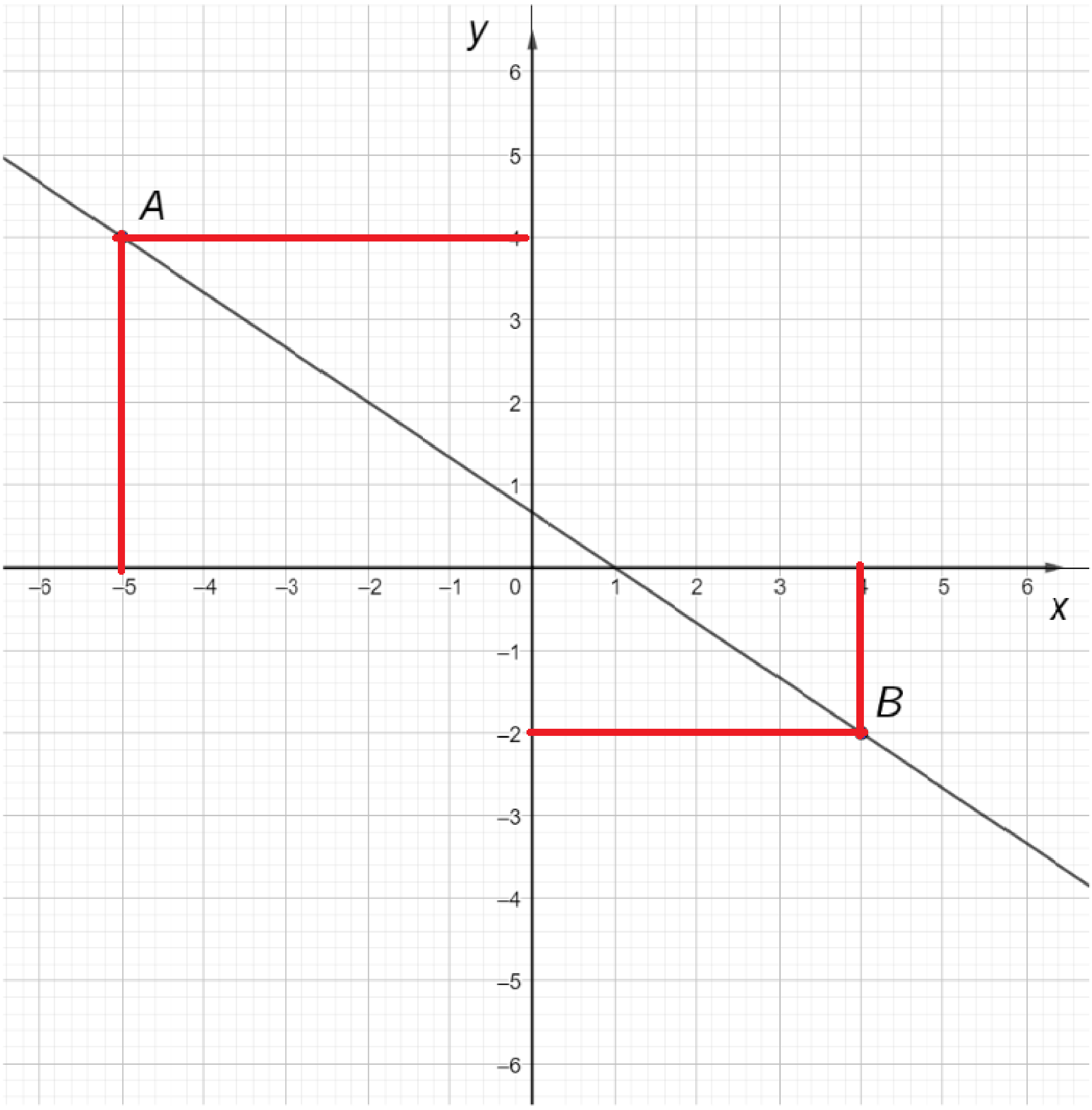
Abs247.

MU123
TMA 03 2021J

Question 1



(a)

(i) The coordinates of the graph (as above):

Point A: (-5, 4) ✓

$\frac{1}{1}$ Point B: (4, -2) ✓

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(ii) The gradient of the slope.

Gradient of the line (4,-2) (-5,4)

Start with WHAT you are finding a value for

Formula: m = $\boxed{\dfrac{y^2 - y^1}{x^2 - x^1}}$

Be careful with notation:

- y is a variable
- y^2 means "y squared"
- y_2 is a specific value of y
- $y2$ means " y multiplied by 2"
-

As all values you are using in this calculation are particular values of the variables, they should all be subscripted. So you need

Gradient $= \dfrac{y_2 - y_1}{x_2 - x_1}$

Variables: $y^2 = 4.$

$y^1 = -2.$

$x^2 = -5.$

$x^1 = 4.$

Start by entering the values into the formula.

m = $\dfrac{4-(-2)}{-5 - 4}$

You have written a series of unexplained sums, as you haven't started with WHAT you are finding a value for.

Best practice is to link equal quantities with equals signs rather than describing what you are going to do.

Calculate the Values

m = $\dfrac{4-(-2)}{-5-4} = \dfrac{6}{-9}$

Divide the numerator by the denominator

m = $\dfrac{6}{-9} = -\dfrac{2}{3}$

$\boxed{\text{Answer}}$: $-\dfrac{2}{3}$ ✓

$\dfrac{2}{2}$

Never write "Answer", as it tells us nothing about what this represents. You need "The gradient of the line is"

Better:

The gradient is calculated as:

$$\text{gradient} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4-(-2)}{-5-4} = \frac{6}{-9} = -\frac{2}{3}.$$

The gradient of the line that passes through the points A and B is $-\dfrac{2}{3}$.

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(b)

(i)

Find equation for a line that passes through the point (−4, 4) and has a slope of $\frac{2}{5}$.

Rather than writing "formula", it is better to say what the formula represents

$(\overset{x_1}{-4}, \overset{y_1}{4})$ and $M = \frac{2}{5}$

the equation of a straight line is given by

Formula : $y - y_1 = m(x - x_1)$

Replace y_1, x_1 and m values.

$y - 4 = \frac{2}{5}(x - (-4))$

Find value for the b variable.

$y = \frac{2}{5}x - 4 + b$

$b = 4 - (\frac{2}{5})(-4)$

$b = \frac{28}{5}$

This form is preferable

The equation of the line is

Answer : $y = \frac{2}{5}x + \frac{28}{5} \simeq 0.4x + 5.6$ ✓ Good

Please try to write the variable *x* as *x* and not x, so we don't get confused with a multiplication sign.

3
—
3

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(ii)

Determine whether or not the Point (-3,4) lies on the line
$y = 0.4x + 5.6$.

Formula : $y = mx + b$.

$y = 4$.
$m = \frac{2}{5}$.
$x = -3$.
$b = 5.6$.

$y = \frac{2}{5}x + 5.6$

Replace x and y variables with Correct Values

$4 = \frac{2}{5}(-3) + b$

I'm not entirely sure what you are doing. Not what you say you are doing, particularly when you say "solve for m and *x*", which means "find values for m and *x*".
This is not the correct method, and seems rather complicated.

Solve for m and x.

$\frac{2}{5}(-3) = -\frac{6}{5}$

Replace variable b with Correct Value.

$4 = -\frac{6}{5} + 5.6$

How can you solve for m, *x*, and b when you seem to already have values for them?

Solve for x and b variables.

$-\frac{6}{5} + 5.6 \simeq 4.4$

The Point (-3,4) is NOT on the line of
$y = 0.4x + 5.6$ ✓

1 mark for conclusion, but I can't tell how you got here.
The correct method is to substitute the value of *x* into the equation, find the corresponding value of y and then compare with the given y coordinate.
[See Unit 6, p.80, Example 2; p.81, Activity 2]

$\frac{1}{2}$

(iii)

Find the x-intercept of the line
$y = 0.4x + 5.6$

Start by replacing y with zero.

$0 = 0.4x + 5.6$

Do not think about "changing signs", as this is not what you are doing. You are subtracting 5.6 FROM BOTH sides of the equation. Always think about what you are doing to both sides.

Change the addition sign to a subtraction.

$0.4x \quad -5.6$

=

Divide each term by 0.4

$$\frac{0.4x}{0.4} = \frac{-5.6}{0.4}$$

$$x = \frac{-5.6}{0.4}$$

x $= \frac{-5.6}{0.4} = -14$

Therefore

$x = -14$

when $y = 0$

So, the x-intercept is $(-14, 0)$

Good

$\frac{2}{2}$

Tell us what these coordinates represent. This is unexplained

Total for Question 1: $\frac{9}{10}$

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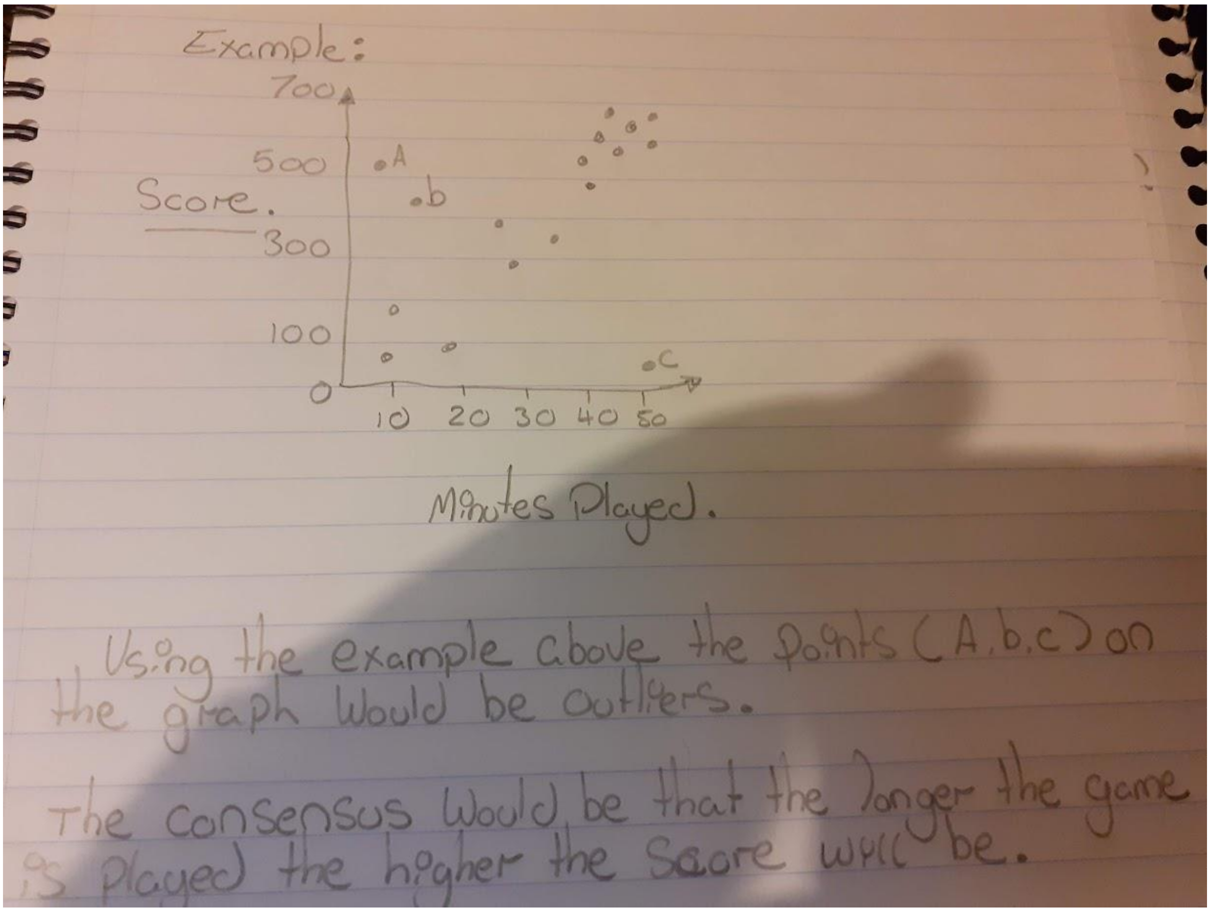
Question 2

(a)

(i) Foremost: an outlier is an abnormal point (value) on a graph which emanates erratically from other points (values) on the same graph.

Below is an example of an outlier on a graph.



Ergo I would ask myself is there any data points that are placed in strange positions within the scatter plot that doesn't fit the model very well? Moreover, I would want to see if a particular value stands out and then to try to understand why they might differ from the ordinary pattern in the data.

2/2

> You are not being asked to give a reason for an outlier though - just what it would look like on the graph.
> A potential outlier is a point that does not seem to follow the pattern of the rest of the distribution.
> The above sentence is sufficient to answer this question. Note that we need the word 'potential' here, as we can't be certain that it really is an outlier.

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(ii)

$\frac{2}{2}$

If x and y have a negative correlation as x increases in value y will decrease similarly if x decreases in value y will increase. Moreover, the higher the negative correlation between two variables the closer the correlation coefficient will be to the value -1.

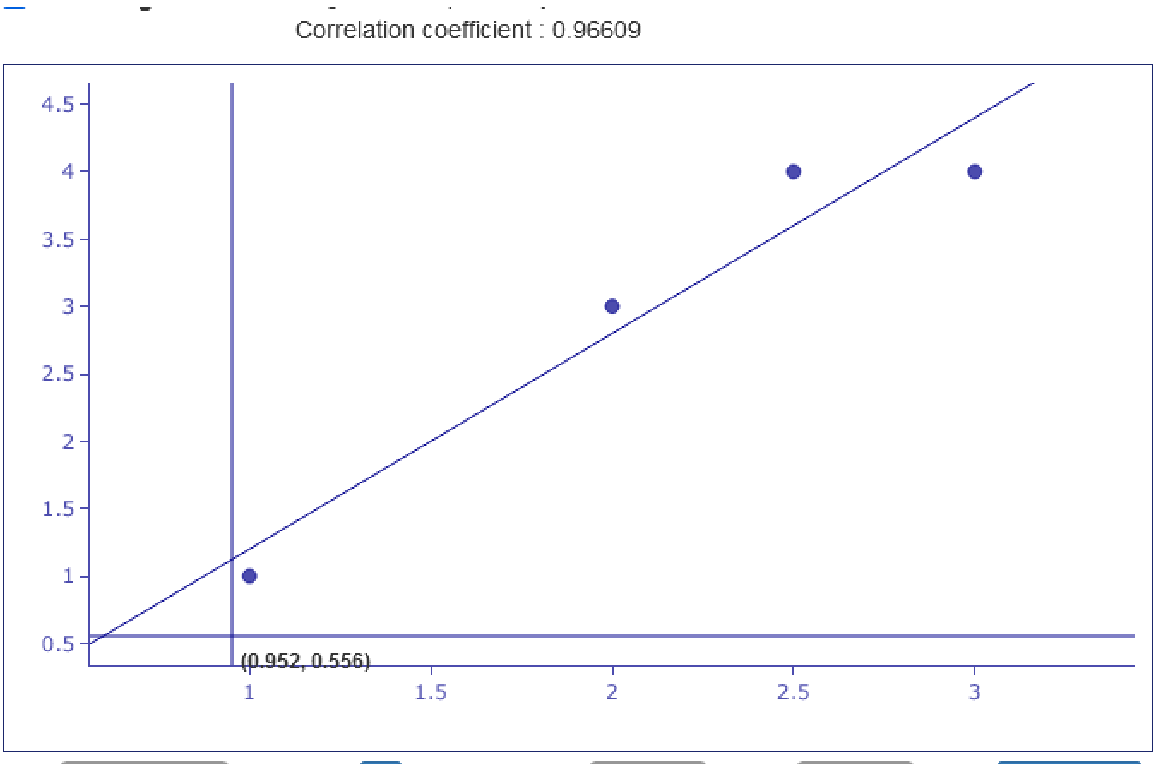
So, you are saying that the data points would roughly fit a straight line with negative gradient?
Note that you are not being asked about the correlation coefficient. We are just interested in how the points look on the graph.

(iii)

If r = 0.9 that would indicate a positive strong (strong: because the number 0.9 is very close to 1) correlation relationship between the variables on the scatterplot. It would also indicate that the data points are close (scattered around the data points) to the regression line. with a positive gradient. (-0.5 mark for not mentioning this)

$\frac{1\frac{1}{2}}{2}$

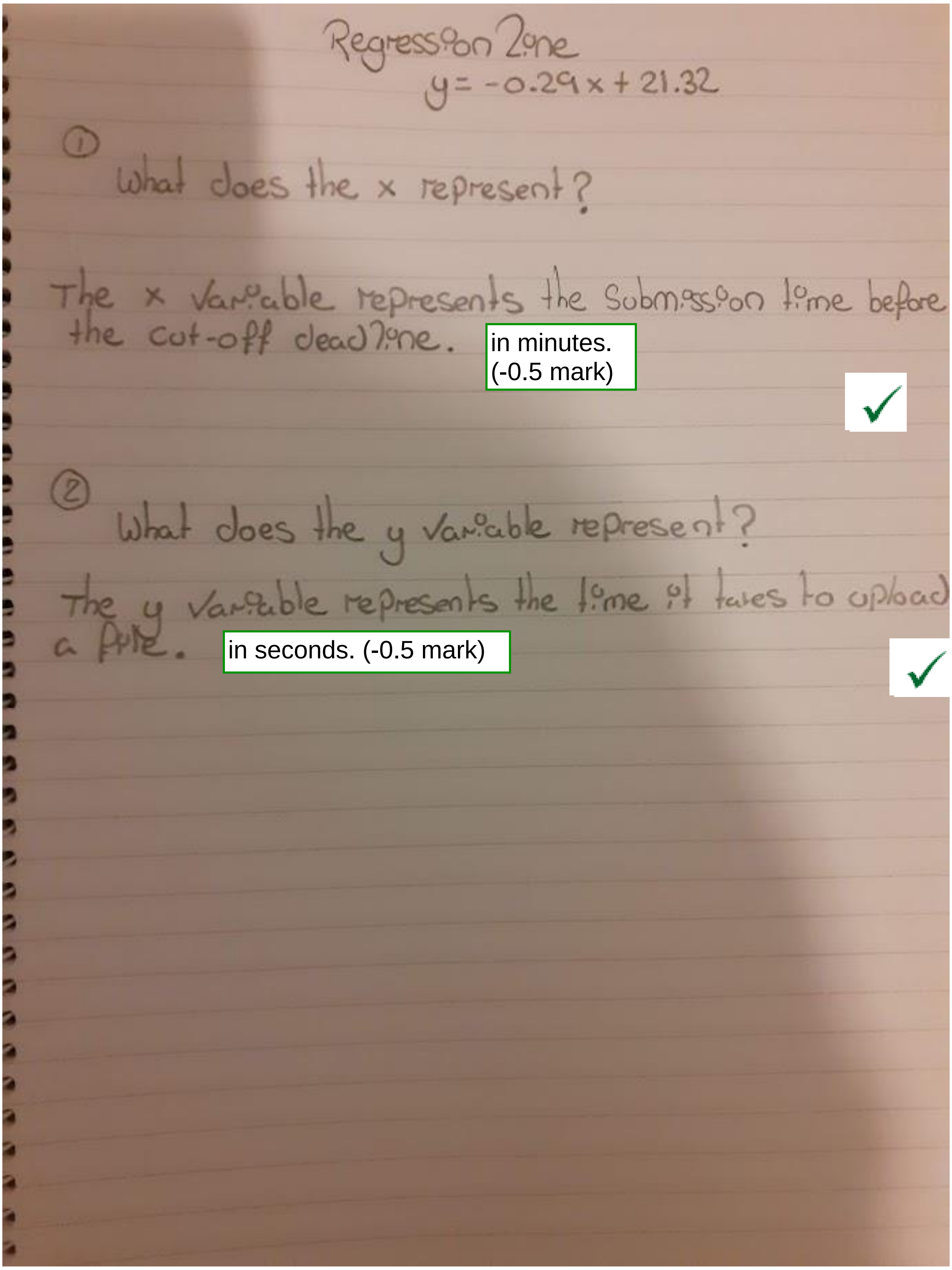
We can see from the image below (img: 1.0) that there is a positive strong correlation coefficient.



[img: 1.0]

(b)

(i)



Regression Line
$y = -0.29x + 21.32$

① What does the x represent?

$\frac{\frac{1}{2}}{1}$ The x variable represents the submission time before the cut-off deadline. in minutes. (-0.5 mark) ✓

② What does the y variable represent?

$\frac{\frac{1}{2}}{1}$ The y variable represents the time it takes to upload a file. in seconds. (-0.5 mark) ✓

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(ii) If the value is -0.92 this would indicate a strong negative correlation between x and y because the number is very near 1.

$\frac{2}{2}$

the time of submission and the time taken to upload the file

-1. But I will give you the benefit of the doubt

(iii)

Use the regression equation
$y = -0.29x + 21.32$ to predict time
to upload file.

Twentyone minutes from final hour.
(21)

Regression equation
$y = -0.29x + 21.32$

Insert 21 into x variable in equation
$y = -0.29(21) + 21.32 \approx 15.23$

Final Result
$y = 15.23$

Time to upload file is 15 seconds (to nearest Sec).

3/3 ✓ Very good

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(iv)

When the (submission time) minutes from the hour (value) increases; the time to upload the file decreases. This is evidence that the time will change and speed up the closer to the submission time.

$\frac{0}{2}$

You cannot conclude that the proximity to the deadline determines the time it takes to upload a file to the eTMA system.

Even though the correlation coefficient is close to -1, strong correlation does not prove a cause and effect relationship. You can't say that one thing causes the other. Even if you saw the graph and the points were very close to the line (which they will be with a correlation coefficient close to -1), you still can't say that one thing determines the other.

There may be other factors which affect time taken to upload the file (e.g. number of students trying to submit at the same time, internet speed, size of file, etc.).

For an amusing illustration of this, you may like to look at https://www.tylervigen.com/spurious-correlations

[See Unit 6, p. 112 – 113]

Total for Question 2: $\frac{11\frac{1}{2}}{15}$

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Question 3

(a)

Make k the subject of the following equation.

$$9t = \frac{7k}{4} + 5$$

Misuse of equals sign. It is incorrect to start an equation with an equals sign. Equals signs are for linking equal expressions.

$$\boxed{\cancel{=}}\ \frac{7k}{4} + 5 = 9t$$

$$\boxed{\cancel{=}}\ \frac{7k}{4} = 9t - 5$$

$$\boxed{\cancel{=}}\ \underbrace{\frac{7k}{4} \cdot 4}_{7} = \underbrace{9t \cdot 4}_{36} \underbrace{-5 \cdot 4}_{-20}$$

Please do not use a dot for multiplication. It is easily mistaken for a decimal point

$$\boxed{\cancel{=}}\ 7k = 36t - 20$$

$\frac{1\frac{1}{2}}{2}$

$$k = \frac{36t}{7}\ \boxed{-\ -}\frac{20}{7}$$

You have two minus signs here, which would result in a plus. This is incorrect. (-0.5 mark)

Slightly better layout:

The equation is:	$9t = \frac{7k}{4} + 5$
Multiply both sides by 4:	$4(9t) = 4(\frac{7k}{4} + 5)$
Multiply out the brackets:	$36t = 7k + 20$
Required subject on one side:	$36t - 20 = 7k$
Divide by 7:	$k = \frac{36t - 20}{7}$

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(b)

Make k the Subject of the following equation.

$$8k = \frac{11k}{5t} + 14t$$

$$\cancel{=}\ \frac{11k}{5t} + 14t = 8k$$

$$\cancel{=}\ \frac{11k}{5t} = 8k - 14t$$

$$\cancel{=}\ 14t = 8k - \frac{11k}{5t}$$

$$\cancel{=}\ \underbrace{14t \cdot 5}_{70} \quad \underbrace{8k \cdot 5}_{40} \quad \underbrace{-\frac{11k}{5t} \cdot 5}_{-11}$$

40 kt

-11 t

$$\cancel{=}\ 70t^2 = \boxed{40t}\ \cancel{=}\ \boxed{-11}$$

You seem to be saying that you are multiplying through by 5 here. But your next line demonstrates that you actually multiplied through by 5t on the LHS, but 5 on the RHS. You need to do the same thing to both sides.

Where has k gone in this equation?

Spurious equals sign

$$\cancel{=}\ k = \frac{70t^2}{40t - 11}$$

There is no indication of how you got to this final result. It is correct, but doesn't follow from your working.
1 mark for answer only.
See next page for correct solution.

$\frac{1}{3}$

Total for Question 3: $\frac{2\frac{1}{2}}{5}$

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(b) The equation is: $8k = \frac{11k}{5t} + 14t$

Multiply both sides by $5t$: $5t \times 8k = 5t\left(\frac{11k}{5t} + 14t\right)$

Multiply out brackets: $5 \times 8 \times t \times k = \frac{5t \times 11k}{5t} + 5 \times 14 \times t \times t$

Simplify: $40tk = 11k + 70 \times t \times t = 11k + 70t^2$

Subtract $11k$ from both sides to get all terms with a k in them on one side: $40tk - 11k = 70t^2$

Take k out as a common factor: $k(40t - 11) = 70t^2$

Divide both sides by $(40t - 11)$: $\frac{k(40t-11)}{(40t-11)} = \frac{70t^2}{(40t-11)}$

Simplify: $k = \frac{70t^2}{40t-11}$ (Assuming $40t - 11 \neq 0$)

[See Unit 7, p.176 – 177 , Strategy; Example 13 and Activity 19. Handbook, p.45]

Question 4 (a)

Table 1.

Total cost in pounds for each item.

Number of People attending	12	20	25
Option A	310	430	505
Option B	275	435	535

2/2 ✓

Option A: price £15.00 per person, plus booking fee of £130.00.

$y = 15(12) + 130 = 310$

$y = 15(20) + 130 = 430$

$y = 15(25) + 130 = 505$

Option B: price £20.00 per person, plus booking fee of £35.00.

$y = 20(12) + 35 = 275$

$y = 20(20) + 35 = 435$

$y = 20(25) + 35 = 535$

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(b)
(i)

If y is the total cost (in pounds) then y equals the charge per person (£15 or £20) multiplied by the variable x; x being the number of people (12, 20, 25).

i.e. $y = 15(12)$
$(15 * 12)$

y = charge * number of people.

incorrect symbol

1/1

We then add the booking fee to the previous result; in this case the booking fee would be £130.00 (option A) £3500 (option B). ✓

Which gives y = 15x + 130

$y = 15(12) + 130 = 310.$

$(15 * 12) + 130 = 310.$

?

Note that demonstrations of calculations are not required, or helpful. This just shows a result for x = 12. It doesn't cover any other values. This is why we need the general description above, which does cover all possible values of x.

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(ii)

If the original equation for solving the total cost of people attending is $y = 15x + 130$; where y equals the total cost and 15 equals the charge per person with 130 being the booking fee.

We can change the charge per person to 20 and the booking fee to 35.

1/1

$$y = 20x + 35.$$ ✓

The x variable represents the number of people.

$$y = 20(12) + 35$$ not required

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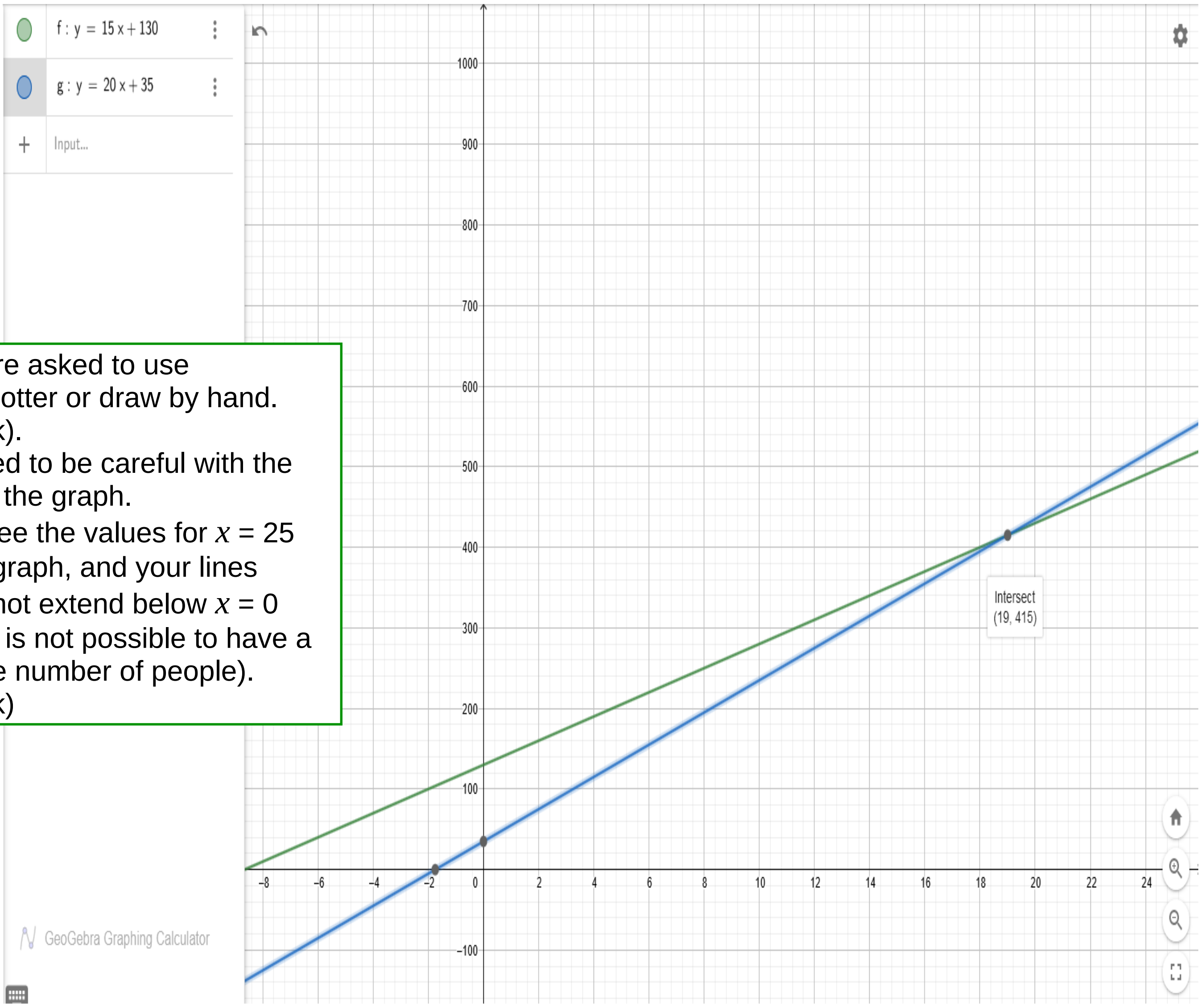
(c) (i)



You were asked to use Graphplotter or draw by hand. (-1 mark).
You need to be careful with the limits of the graph.
I can't see the values for $x = 25$ on this graph, and your lines should not extend below $x = 0$ (since it is not possible to have a negative number of people).
(-1 mark)

$\frac{2}{4}$

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(ii)

Green line: $y=15x+130$.

You need to typeset ALL of the maths.

Blue line: $y=20x+35$.

The gradient of the line represents a positive slope with the green line showing a higher rate of cost at first; both lines become equal when the number of people is 19. Moreover, the blue line overtakes the green line thereafter indicating the cost is higher. ✗

$\frac{0}{1}$

You needed to interpret the gradient in terms of the situation being modelled. You have described what the graph looks like, which isn't what was required.

The gradients in both cases represent the cost of entry per person.
[See Unit 6, Sections 2.3 and 2.4; Handbook, p.43]

(2)

The y-intercept represents the overall cost of the equation, we can see from image below that the equation y=15x+130 (where x = 10) is equal to 280.

0
—
1

The y-intercepts are where the graphs cross the y-axis. Therefore, the y-intercepts represent the fixed cost of the booking fee. That is, the cost when no people attend.

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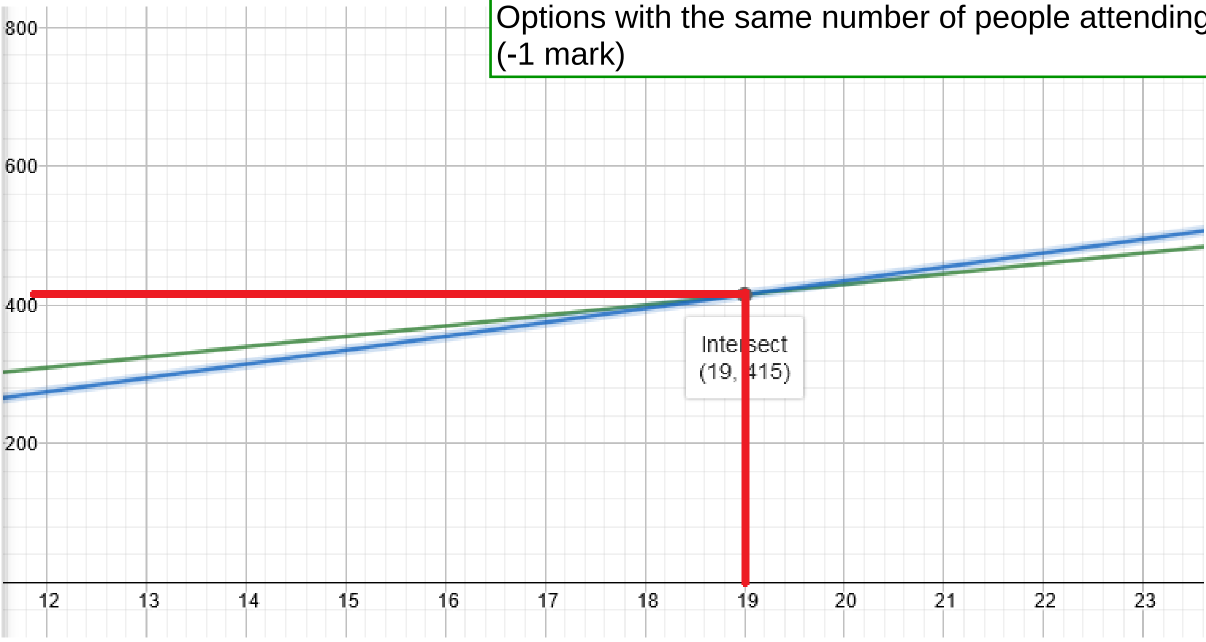
(d)

$\frac{1}{2}$

point of intersection

The intersect is (19, 415).

Fair enough, but you needed to say what this represents too.
It is the point at which the cost is the same for both Options with the same number of people attending.
(-1 mark)



Finding Points of intersection from two equations.

Label the equations so that we can refer to them easily later

Solve for x.

(1) $y = 15x + 130$, (2) $y = 20x + 35$

$15x + 130 = 20x + 35$

since both LHS are y, we can equate the RHS

$15x - 20x = 130 - 35$

$-5x = 95$

$\boxed{\frac{-5}{95} = \frac{1}{19} \quad x = 19.}$

Is this all one equation or two separate equations? Please write equations on separate lines. Where is the x in the first equation?

Solve for y.

$\boxed{\begin{array}{l} y = 15 \cdot 19 = 285. \\ y = 15(19) + 130 = 285 + 130 = 415. \end{array}}$

$y = 415$.

This is very puzzling. You haven't said which equation you are using to find a value for y. And you have said that y is equal to both 285 and 415. It can't be equal to both. (-1 mark)

So the solution is

Answer: $x = 19$.
$y = 415$.

✓

$\frac{3}{4}$

At this point, it is a good idea to check by substituting $x = 19$ into equation (2) to make sure you get the same value for y.

Substitute $x = 19$ into equation (1),

$$y = 15 \times 19 + 130 = 415$$

So the solution is $x = 19$, $y = 415$.

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(e)

Solve two Simultaneous equations ($y=15x+130$, $y=20x+35$).

$y = 15x + 130.$
$y = 20x + 35.$

I have no idea what you are doing here.
This is a page of unexplained working, resulting in the wrong answer.

$y \cdot y = y$
$y \cdot 15 = 15$
$y \cdot 130 = 130$

$\boxed{\begin{array}{l} y \cdot y = y \\ y \cdot 20 = 20 \\ y \cdot 35 = 35 \end{array}}$

Incorrect notation and meaningless equations.
I presume you are using a dot for multiplication? If so, y x y = y^2, not y.
The other working is wrong too.

$\frac{y}{y} = 0$ | $\frac{15}{20} = 5$ | $\frac{130}{35} = 95$

No idea what you are telling me here

$\frac{95}{5} = 19.$

$y = 19.$

Solve for x.

$15(19) = 285.$

$285 + 130 = 415.$

$x = 415.$

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(f)

For a low number of people option B would be a cheaper choice but if a large number of people are attending then option A would be a better choice.

High Number of People:

(20, 35, 45, 50)

Option A.	Option B.
15(20) + 130 = 430.	20(20) + 35 = 435.
15(35) + 130 = 655.	20(35) + 35 = 735.
15(45) + 130 = 805.	20(45) + 35 = 935.
15(50) + 130 = 880.	20(50) + 35 = 1035.

I don't need to see calculations for varying numbers of people. I need an exact number of people for which each option is cheapest.

Never present working by the side of other working

Using the data above We Can See option A is better Value for larger groups of People.

Low Number of People:

(3, 5, 7, 10).

Option A.	Option B.
15(3) + 130 = 175.	20(3) + 35 = 95.
15(5) + 130 = 205.	20(5) + 35 = 135.
15(7) + 130 = 235.	20(7) + 35 = 175.
15(10) + 130 = 280.	20(10) + 35 = 235.

option B is better Value for low Numbers of People.

$\frac{0}{2}$

Specifically:
For 18 people or fewer, Option B works out cheaper.
For 20 people or more, Option A works out cheaper.
For 19 people, the cost is the same.

Note that you didn't need any calculations as this information can be gleaned from the intersection point.

[See Unit 7, p.197, Activity 32]

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(g)

10 % off option B with 21 or more people.

Original Equation
$y = 20x + 35.$

Insert value 21 into equation.

y = $20(21) + 35 = 455.$

When you substitute into the equation, you must not lose the left hand side.

Calculate 10% off 455.

Amount of discount = $455 \div 100 * 10 = 45.50.$

You have misunderstood the situation. You have discounted 10% from the whole cost. But the question says that the 10% discount applies to the entry cost only, not the booking cost.

Subtract 45.50 from original total.
$455 - 45.50 = 409.50.$

✗

Price with 10% discount with twentyone people is 409.50. Option B will be better value.

But what are you comparing it with? How much is it for 21 people attending Option A?

$\frac{1}{2}$/2

Conditional Statement:
if $x \geq 21$ then S.

$x = 21.$
$(b = x * 20 + 35).$
$p = (b / 100) * 10.$
$S = b - P.$

What is this? This seems to be some kind of computer code. However, you haven't said what b, p or s represent, so I've no idea what this means (and I'm a programmer!). Please leave computer code out of maths assignments.

See next page for correct solution

Total for Question 4: $\frac{10\frac{1}{2}}{20}$

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Comment 2

A well-explained solution:

Before discount, the costs for 21 people attending the activity day would be:

Option A: $y = 15x + 130 = 15 \times 21 + 130 = £445$

Option B: $y = 20x + 35 = 20 \times 21 + 35 = £455$

With the discount of 10%, the cost of entry price per person at Option B would be $20 \times 0.9 = £18$

Therefore, the equation for Option B becomes $y = 18x + 35$

The revised cost for 21 people to attend Option B is

$y = 18 \times 21 + 35 = £413$

Thus, Option B is now $£455 - £413 = £42$ cheaper, and £32 cheaper than Option A.

Therefore, Alexa should switch to Option B to get a better deal.

Question 5

(a)

(i)

Surface Area of a Hemisphere.

Total Surface area of a hemisphere $= 3\pi r^2$

$\pi = 3.1416$ ✗

No. π is NOT equal to this number. Never approximate π. Use the π button on your calculator.

$r = 14$

Surface area of hemisphere =

Start with WHAT you are finding a value for

$3(3.1416)(14)^2$

-0.5 for approximating π.
-0.5 for no conclusion.

≈ 1847.26

$= 1800 cm^2$ (2 s.f)

Write a conclusion!

$\frac{1}{2}$

The surface area of a sphere is given by $S = 4\pi r^2$ where S is the area and r is the radius. So the area of a hemisphere is $H = \frac{1}{2} \times 4\pi r^2 = 2\pi r^2$.

The area of the flat top is a circle. So, the area of the top of the solid hemisphere is given by $T = \pi r^2$, where T is the area.

So the total area is given by $A = S + H = 4\pi r^2 + \pi r^2 = 3\pi r^2$, where A is the surface area.

We have $r = 14$, so

$$\begin{aligned} A &= 3\pi \times 14^2 \\ &= 588\pi \\ &= 1847.256\ldots \end{aligned}$$

So, the surface area of the hemisphere is $1800\ cm^2$ (to 2 s.f.)

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(ii)

Volume of hemisphere.

Undefined variable.
What is this?

$$\boxed{V\phi} = \frac{2}{3} \times \pi \times r^3$$

$$\pi = 3.1416$$

$$r = 14$$

-0.5 mark for approximating π;
-0.5 mark for no explanation of what your answer represents.
Where is your conclusion?

Volume of the hemisphere = $\dfrac{2(3.1416)(14)^3}{3}$

$$\approx 5747.03$$

$$= 5700\ cm^3\ (2\ s.f)$$

$\frac{1}{2}$

The volume (measured in cm^3) of a sphere of radius r is $\frac{4}{3}\pi r^3$.

Therefore, the volume of a hemisphere is $\frac{1}{2} \times \frac{4}{3}\pi r^3 = \frac{2}{3}\pi r^3$.

We have $r = 14$, therefore

$$\begin{aligned}\text{The volume} &= \frac{2}{3} \times \pi \times 14^3 \\ &= \frac{5488}{3}\pi \\ &= 5747.0\ldots\end{aligned}$$

So the volume of the hemisphere is $5700\,\mathrm{cm}^3$ (to 2 s.f.).

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(iii)

Find length of BC
Using Pythagoras Theorem.

AB = 24cm
AC = 48cm

Pythagoras' Theorem states

Formula: $c = \sqrt{a^2 + b^2}$

$a = \sqrt{c^2 - b^2}$

a, b and c are undefined. So, you need to say what they represent. Much better to write the whole solution in terms of the symbols in the question. Then we know what you are talking about.

Always start with WHAT you are finding a value for. Never just write a sum

$a = \sqrt{48^2 - 24^2} \approx 41.56$

This is an approximation. You need to give the full answer.

$42cm\ (2\ s.f) = BC^2$ ✘

No. BC^2 is not 42cm (to 2 s.f.). BC is 42cm. (to 2 s.f.) (-0.5 mark)

$\frac{1\frac{1}{2}}{2}$

Better:

Using Pythagoras' Theorem in triangle ABC, with each side measured in cm, we have

$$AC^2 = AB^2 + BC^2$$
$$48^2 = 24^2 + BC^2$$
$$48^2 - 24^2 = BC^2$$
$$1728 = BC^2$$
$$BC = \sqrt{1728} = 24\sqrt{3} = 41.5\ldots$$

The length of BC is 42 cm (to 2 s.f).

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(iv)

The word 'formula' gives very little clue to what this represents or what the variables are. You need more of an introduction, with definitions.

depth of cuboid.

Formula: $V = whl$

Explain what you are working out and what your reasoning is.

l = length 24 cm.

h = height 42 cm. ✗

V = Volume 11400.

No. You must never use rounded values in calculations.

Volume of what? This seems to be rounded as well

Solving for w.

But I don't know what w is

$$w = \frac{V}{hl} = \frac{11400}{42 \cdot 24} \approx 11.31$$ ✗

$\frac{1\frac{1}{2}}{4}$

Look at this without looking at the question. What have you found a value for and in what units? What is the accuracy of your answer? You've given no explanation.

-1 for no explanation;
-0.5 for no conclusion with correct units;
-0.5 for using rounded values in calculations;
-0.5 for incorrect rounding

The volume of the hemisphere is $\frac{5488}{3}\pi\,\mathrm{cm}^3$

The volume of a cuboid is given by whd, where w is the width, h is the height and d is the depth.

So the volume of the cuboid is $AB \times BC \times AD$, with each side measured in cm.

We have

$AB = 24$.

$BC = 24\sqrt{3}$ from part (a)(iii).

The volume of the cuboid is $2 \times \frac{5488}{3}\pi = \frac{10976}{3}\pi$

Therefore

$$24 \times 24\sqrt{3} \times AD = \frac{10976}{3}\pi$$

$$\begin{aligned} AD &= \frac{10976}{3 \times 24 \times 24\sqrt{3}}\pi \\ &= 3.66\ldots\pi \\ &= 11.5\ldots \end{aligned}$$

So the depth of the cuboid is 12 cm (to 2 s.f.).

Reference
Unit 8, page 69, Table 4, Handbook, page 49.

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b)

Student question.

For pair (1).

The first case is correctly labled as a SSS (side-side-side); because all lengths of the triangle are the same. Moreover, the student is also correct by saying that the triangles are congruent.

$\frac{2}{2}$

I think you mean that the lengths of the sides in the first triangle are equal to the lengths of the sides in the second triangle?

✓

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(b)

Student question.

For Papr (2).

The Second Case is labled incorrectly as it should be AAA (angle-angle-angle).
The sides of the triangle are not corresponding (although they share the same size of 15cm).

The triangles are not congruent so the student is wrong by saying they are congruent.

$\frac{1}{2}$

I'm not sure what you mean by labelling, as the 'AAA' case is a test of whether the triangles are congruent on that condition (i.e. all angles are the same). It isn't a label. Note that the AAA case would tell us that the triangles were similar, but not necessarily congruent.
You need to point out that the angles are the same, but the side of 15cm is not between the same two angles in each triangle. So, the triangles are not congruent by ASA.

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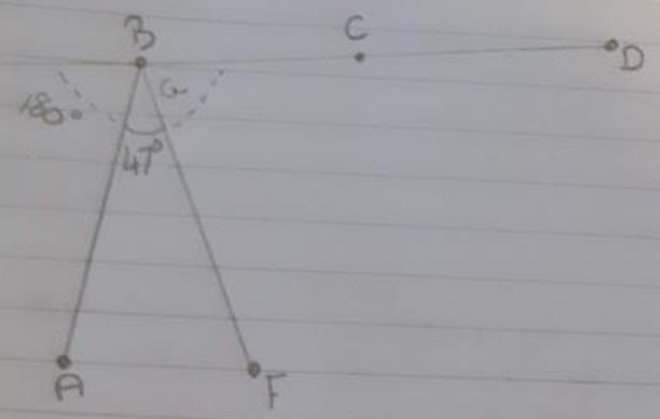
(c)

(i)



$\angle ABF = 47°$

BD is on a straight line, so it is equal to 180° : $180° - 47° = 133°$.

$BD = 180°$

$BD - \angle ABF = 133°$.

✗

BD IS a straight line. It is not an angle, so can't be 133°.
You haven't worked out the value of angle α, which is what you were asked for.

$\frac{0}{1}$

FB is parallel to EC.

$\angle ECD$ and $\angle\alpha$ are corresponding or F angles so are equal.

Therefore $\angle\alpha = 86°$.

Reference Unit 8, page 11 and page 13, Activity 7, Handbook, page 47.

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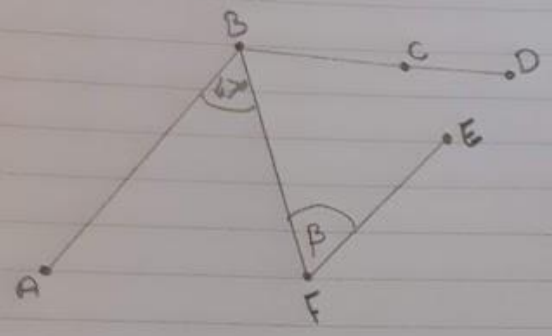
(ii)



The lines AB and FD are parallel so $\angle ABF$ and $\angle BFE$ are alternate angles. and, therefore, equal

$\angle \beta = 47°$.

This is the conclusion, so it should come at the end.

$\frac{1}{1}$ $\angle ABF = 47° = \angle BFE = 47°$. ✓

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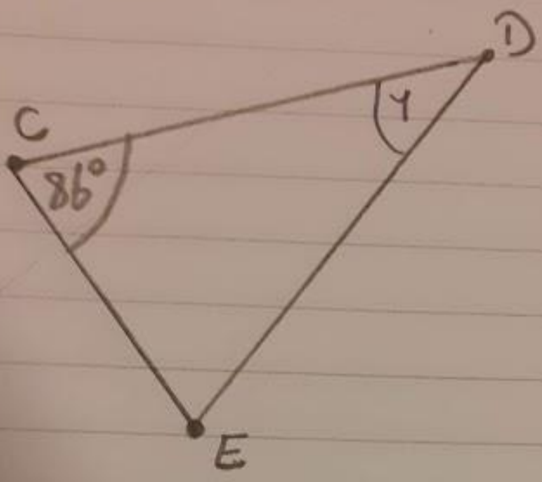
(iii)



Find $\angle \gamma$

$\gamma = 180° - \angle CDE = 180° - 86° = 94°.$ ✗

But γ IS angle CDE.

The three internal angles of a triangle add up to 180°.

So $\angle\alpha + \angle\beta + \angle\gamma = 180°$

Therefore $\angle\gamma = 180° - 86° - 47° = 47°$.

Reference Unit 8, page 14, Activity 9.

$\frac{0}{2}$

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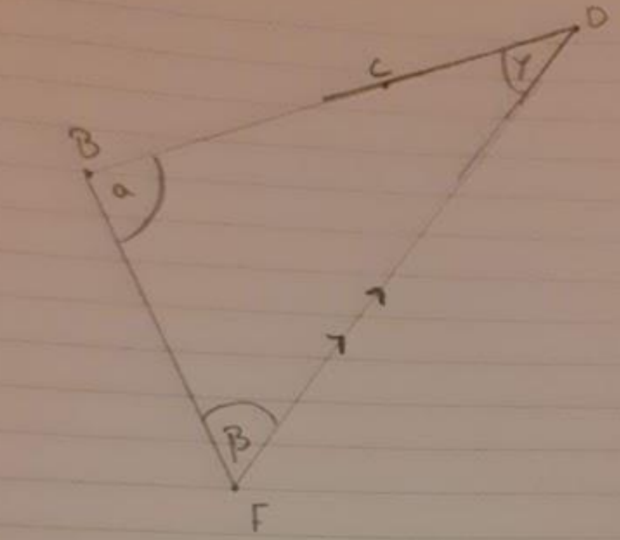
(iv)



The triangle above has two equal angles ∠abf (a) and ∠bfd (b); base angles, which means the triangle is called an isosceles triangle.

Because the $\angle\beta$ and $\angle\gamma$ are equal, this means that the base angles of triangle FBD are equal and so opposite sides BD and FB have the same length.

Therefore, triangle FBD is an isosceles triangle.

$\frac{1\frac{1}{2}}{2}$

You need to say that the sides are equal too.
(-0.5 mark).
Be careful to use correct notation.

Total for Question 5: $\frac{10\frac{1}{2}}{20}$

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Question 6

(a)

(i)

Find the Number of terms n of the Sequence.

3, 8, 13, ..., 58

Use the formula:

The number of terms, n, is given by

$$n = \frac{l - a}{d} + 1$$

$a = 3.$

$d = 5.$

$l = 58.$

a is the first Number of the Sequence (3).

d is the difference in the Sequence (5).

l is the last term of the Sequence (58).

Insert Values into formula:

$$n = \frac{58 - 3}{5} + 1 = 12.$$

$n = 12.$

$\frac{2\frac{1}{2}}{3}$

You were asked to check your answer. To do this, write down all the terms in the sequence and count them. (-0.5 mark)

O.K., so you have a value for n. So what does this represent? You need a conclusion. If you look at your answer carefully, you don't say what n is at any point.

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(ii)

Find the Sum of the Arithmetic Sequence.

3, 8, 13, . . . , 58

Formula for Sum :

$$\text{Sum} = \frac{n(2a + (n-1)d)}{2}$$ ✓

$a = 3.$
$d = 5.$
$l = 58.$
$n = 12.$

$$\text{Sum} = \frac{12(2(3) + (12-1)(5))}{2}$$

$= 366.$ ✓

The Sum of the Sequence is 366. ✓

Very good

$\frac{2}{2}$

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(b)
(i)

Expand Brackets
$(5x - 9)(6x + 7)$

You should not split up the multiplication into separate terms. It is easy to make mistakes with signs if you do this.
You should not describe mathematical operations. Instead, keep the whole expression together and link equal expressions with equals signs.

Multiply the Same Variables.

$5x \cdot 6x = 30x^2$

Multiply first Value in first brackets by Second Value in Second bracket.

$5 \cdot 7 = 35$

Do not use a dot for multiplication

Multiply Second Value in first brackets by first Value in Second brackets.

$-9 \cdot 6 = -54$

Multiply Second Value in first brackets by Second Value in Second brackets

$-9 \cdot 7 = -63$

If you start with an equals sign, you are saying this is exactly equal to the last thing you wrote on the line above. As that was -63, this is a misuse of the equals sign.

$= 30x^2 + 35 - 54 - 63$

Multiply 35 by -54

$35 \cdot -54 = -19$

$= 30x^2 - \boxed{19} - 63.$ ✘

-19x

Better:

$$(5x - 9)(6x + 7)$$
$$= 30x^2 + 35x - 54x - 63$$
$$= 30x^2 - 19x - 63$$

$\frac{1\frac{1}{2}}{2}$

Misuse of equals sign. This expression is not equal to -19

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(ii)

Expand Brackets

$(3a - 6b)^2$

$3a^2 = 9a^2$

$\boxed{-6^2 = -36ab}$ This cannot be true.

$\boxed{6b^2 = 36^2}$ This can't be true either

What is on the left of this equals sign?

$= 9a^2 - 36ab + 36b^2$ ✓

Better:

$$\begin{aligned}(3a-6b)^2 &= (3a-6b)(3a-6b)\\ &= 9a^2 - 18ab - 18ab + 36b^2\\ &= 9a^2 - 36ab + 36b^2\end{aligned}$$

$\frac{2}{2}$

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(c)

Factor $25h^2 - 36k^2$

Factor 25

$= 5$

You have equated 5 to 25. This is untrue

$5h^2$

What is this equal to? It isn't equal to 5 or 25.

Factor 36

$= 6$

6 is not equal to 36

$6k^2$

What is this equal to

$= (5h)^2 - (6k)^2$

But this is not equal to $6k^2$

Formula:

Formula for what?

$x^2 - y^2 = (x+y)(x-y)$

$x^2 = 5h^2$

$y^2 = 6k^2$

2/2 $(5h + 6k)\ (5h - 6k)$

What is this equal to?

✓

Better:

$$\begin{aligned} 25h^2 - 36k^2 &= (5h)^2 - (6k)^2 \\ &= (5h - 6k)(5h + 6k) \end{aligned}$$

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(d)

(i)

Factor quadratic expression.

$x^2 - 2x - 63.$

Formula:

This is not a formula.
This is an expression

$x^2 + bx + c$

$c = -63$

$b = -2$

$7 \cdot -9 = -63.$

$7 - 9 = -2.$

$x^2 - 2x - 63 =$ $(x+7)(x-9)$

But what is this equal to?

✓ Good

$\frac{2}{2}$

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(ii)

Solve quadratic equation.

$x^2 - 2x - 63 = 0.$

What is this equivalent to?

Check

When $x = 9.$

$x^2 - 2x - 63 = 9^2 - 2(9) - 63 = 0.$

as required

You have not solved the equation. You have just included the checks on the solutions, but you haven't shown how you got those solutions in the first place. (-1 mark)

When $x = -7.$

$x^2 - 2x - 63 = 7^2 - 2(-7) - 63 = 0.$ as required

Both x values fit the equation correctly.

$\frac{1}{2}$

From (d)(i) $(x-9)(x+7) = 0$

So either $x - 9 = 0$ giving $x = 9$

or $x + 7 = 0$ giving $x = -7$

Missing solution

See Unit 9, p.115, Example 7 and Activity 21; Handbook p.50

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(e)

(i)

Substitute $y = 27$ into equation $y^2 - 27y = 0$.

$27^2 - 27y = 0$.

The left-hand side of the equation is equal to the right-hand side.

$27^2 - 27(27) = 0$.

We can see from the above equation that $y = 27$ is correct.

You need to demonstrate that you are just substituting into the left-hand side. To check a solution, you need to work out each side separately, then compare them and reach a conclusion. See Unit 5, p. 41 - 42, Examples 18 and 19

Correct solution:

When $y = 27$

$LHS = y^2 - 27y = 27^2 - 27 \times 27 = 729 - 729 = 0$

$RHS = 0$

Since $LHS = RHS$, then $y = 27$ is a solution to the equation.

$\frac{0}{2}$

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(ii)

Solution to $y^2 - 27y = 0$

$y^2 - 27y = 0$

Solve right side of equation.

You can't solve just one side of an equation. One side of an equation is an expression, which can't be solved. Solving an equation means finding values for the variable(s).

$-27y = y^2$

This is incorrect. I think you meant to add 27y to both sides. If so, the LHS should be positive

$-27y = 729$

where did you get 729 from? Bear in mind that you don't know the value of y at this point

Divide each side by 27.

$\frac{27y}{27} = \frac{729}{27}$

$y = 0$ and $y = 27$.

This does not follow from your working. Your working just leads to the one solution. You wouldn't get y = 0 from this working.
(-1 mark for incorrect working)

$\frac{1}{2}$

The equation is:	$y^2 - 27y = 0$
Factorise :	$y(y-27) = 0$
So:	$y = 0$ or $y - 27 = 0$
So:	$y = 0$ or $y = 27$

Reference
Unit 9, page 115, Activity 21(f).

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(iii)

If the problem is a quadratic equation there must be two roots; the student has only written one which is printed as y=27. Moreover, if the answer is to be correct the student should have written the following y=0 and y=27.

But you haven't explained why their working only leads to one solution. You are right that there should be two roots, but you need to explain why.

$\frac{0}{1}$

(iii) The mistake was when the student divided both sides by y in the third line. Since this is only valid for $y \neq 0$, the student has lost the solution $y = 0$ and has only found one solution.

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(f)

Solve the equation

$$\frac{18}{7-x} = \frac{63}{x+2}$$

$$\frac{18}{7-x} = \frac{63}{x+2}$$

Assuming $x \neq 7$ and $x \neq -2$

$$18(x+2) = 63(7-x)$$

$$18x + 36 = 441 - 63x$$

$$405 = 81x$$

$$\frac{405}{81} = 5$$

$$x = 5.$$

Check Solution:

$$\boxed{\frac{18}{7-5} = 9 \qquad \frac{63}{5+2} = 9}$$

These are two separate calculations, so should be on separate lines. Each one needs to start with WHAT you are finding a value for. How do we know that one is the LHS and the other is the RHS?

Both the LHS and the RHS equal 9.

O.K., so what does that mean? Is your solution correct or not?

$\frac{5}{5}$

Very good

Total for Question 6: $\frac{19}{25}$

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Question 7 – Mathematical Communication: $\frac{2}{5}$

I can see that you've made a big effort with your presentation and communication in this TMA, and most of your work is easy to follow with plenty of room for comments. There are a few adjustments to make for the future though.

Firstly, I do appreciate having plenty of room for comments. However, I think there may be a little too much room, and I feel that 87 pages is a bit too much. I don't really need every other page to be blank, and you don't need to start every question part on a new page. Just leave a reasonable amount of space after every question part and start each question on a new page, and it will be fine.

A few communication points for the future:

- Be careful to use subscripts/superscripts correctly. A superscript is used for the power of a number or variable, e.g. x^2 is x squared. But if you want to indicate that you want a particular value of a variable then you need a subscript, e.g. x_2.
- You must start every calculation or train of working with WHAT you are finding a value or expression for. Never just write a sum.
- You should not describe basic operations in words, e.g. "divide the numerator by the denominator". The mathematical notation does it far better.
- Link equal expessions with equals signs to form a train of working leading to an answer.
- Avoid the word "Answer" as it tells us nothing about what your result represents. For example, instead of "Answer : $-\frac{2}{3}$", write "The gradient of the line is $-\frac{2}{3}$" as this is far more informative. Similar comments apply to "Formula", as this merely tells us you are intending to use an equation or formula. It doesn't tell us what you are trying to use it for.
- Please try to write the variable x as x and not x, to avoid confusion with a multiplication sign.
- Always say what your answer means. Just writing $(-14,0)$ is not very informative. Try reading your solutions without looking at the question paper.
- Don't convert to decimals unless you really have to, as fractions are always exact (advisory).
- Be careful with your use of the equals sign. Equals signs are for linking two equal expressions only. It is incorrect to start an equation with an equals sign. This is why it is very important to know the difference between an equation and an expression.

Continued on next page

- Never use a dot instead of a multiplication sign. It is easily mistaken for a decimal point. You should not use a '$*$' for multiplication either – this is only for communicating with computers or calculators, not with maths tutors!
- Please only write one mathematical statement or equation on each line, unless separated by a word or phrase. Never present working by the side of other working.
- When you substitute a value into an equation, you must keep BOTH sides of the equation. Don't lose one side of it, otherwise it isn't an equation any more.
- Never approximate π. Use the π button on your calculator.
- Follow non-exact decimals with '…'. If you don't, you are stating that the number is exact (so you may be misusing the equals sign).
- You must write conclusions at the end of your solutions, after any reasoning or working.
- You need to define any variables you use in your solution which haven't been directly given in the question. You can't rely on the reader knowing what you mean if you use generic variables from the handbook.
- Make sure you write answers in a logical order, with the conclusion at the end.
- Maths IS case sensitive. So, $\angle bfd$ is NOT the same as $\angle BFD$. Please make sure you are using the correct case.
- You should not split up algebraic working into separate terms as it is hard to follow and prone to errors (it is easy to lose minus signs). Keep expressions or equations together and make sure you link equal expressions with equals signs.
- If you start a line with an equals sign, you are equating your expression to the last thing you wrote on the line above. If they are not equal, you have misused the equals sign.
- Please check that your equations are actually true. For example, you wrote "$-6^2 = -36ab$" on p.71. This can only be true if $a = 1$ and $b = 1$. Mostly, it won't be true. Please check carefully that your working makes sense. For similar reasons, "$6b^2 = 36$" is not true either.
- Careful with the format of checks! If you are checking the solution to a quadratic equation, start with the left-hand side, link equal expressions with equals signs and end up with the answer (hopefully, 0). If checking the solution to equations with expressions on both sides, work out each side separately (and SAY which side you are working out) and then compare and write a conclusion. Always say if your check worked or not.