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SUPERVISOR'S USE ONLY

Level 1 Mathematics and Statistics, 2018

91028 Investigate relationships between tables, equations and graphs

9.30 a.m. Tuesday 20 November 2018
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Investigate relationships between tables, equations and graphs.	Investigate relationships between tables, equations and graphs, using relational thinking.	Investigate relationships between tables, equations and graphs, using extended abstract thinking.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Show ALL working.

Grids are provided on some pages. This is working space for the drawing of a graph or a diagram, constructing a table, writing an equation, or writing your answer.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Achievement

TOTAL 10

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QUESTION ONE

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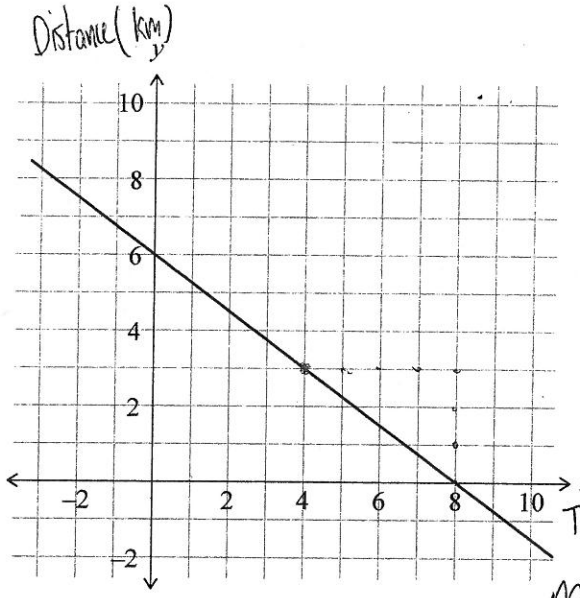
(a) Give the equation of the graph shown below.



$y = mx + c$
m = gradient
c = y-intercept
$m = \frac{\text{Rise}}{\text{Run}}$
$m = \frac{3}{4}$

Equation: $y = -\frac{3}{4}x + 6$

(b) James takes 40 minutes to jog the 5 km from his home to school.

(i) What is James's average speed when he is jogging from his home to school?

$y = -\frac{3}{4} \times 40 + 6$
$= -30 + 6 = -24$

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(ii) Emma lives further away from the school than James.

They leave their homes at the same time.

Emma rides her bike to school, and James jogs to school.

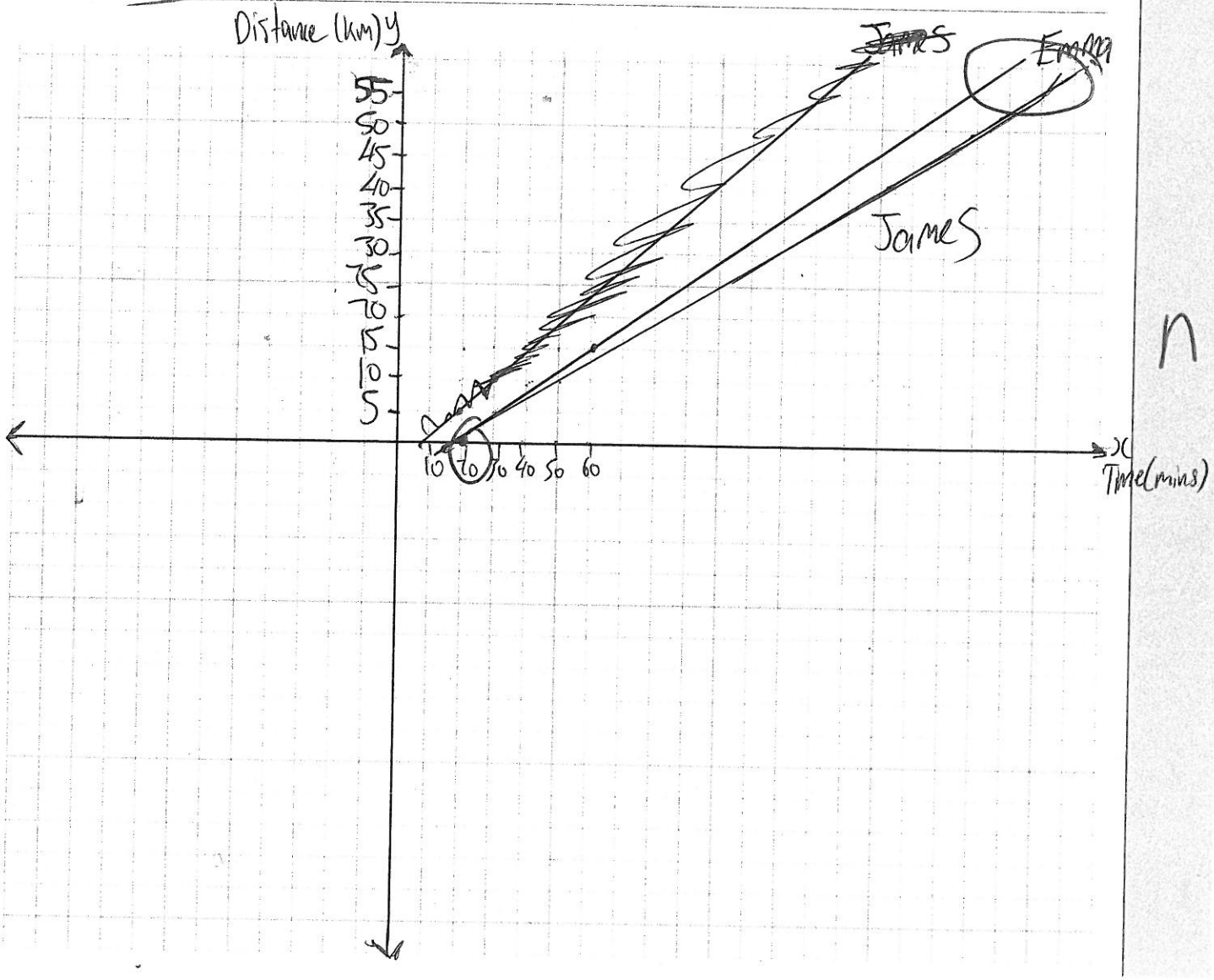
They meet 20 minutes after they leave their homes.

After they meet, both James and Emma change their travelling speeds so they are the same.

James begins running and Emma rides her bike at ¾ of the speed she had been travelling before they met.

They arrive at school 30 minutes after they left their homes.

Represent Emma and James's journeys from their homes on a graph.



(iii) Give the equations that represent Emma's and James's journeys.

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(iv) Describe Emma's and James's journeys to school, including their speeds and how far Emma's home is from the school.

James left and met ~~Emma~~ 20mins later.
Emma ~~was travelling faster than James~~ James at the beggining. After they meet Emma ~~slows~~ changes her speed to match James which means she slows down. Then James begins running and Emma ~~accelerates~~ on her bike giving her a speed of $\frac{3}{4}$ before they met.

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QUESTION TWO

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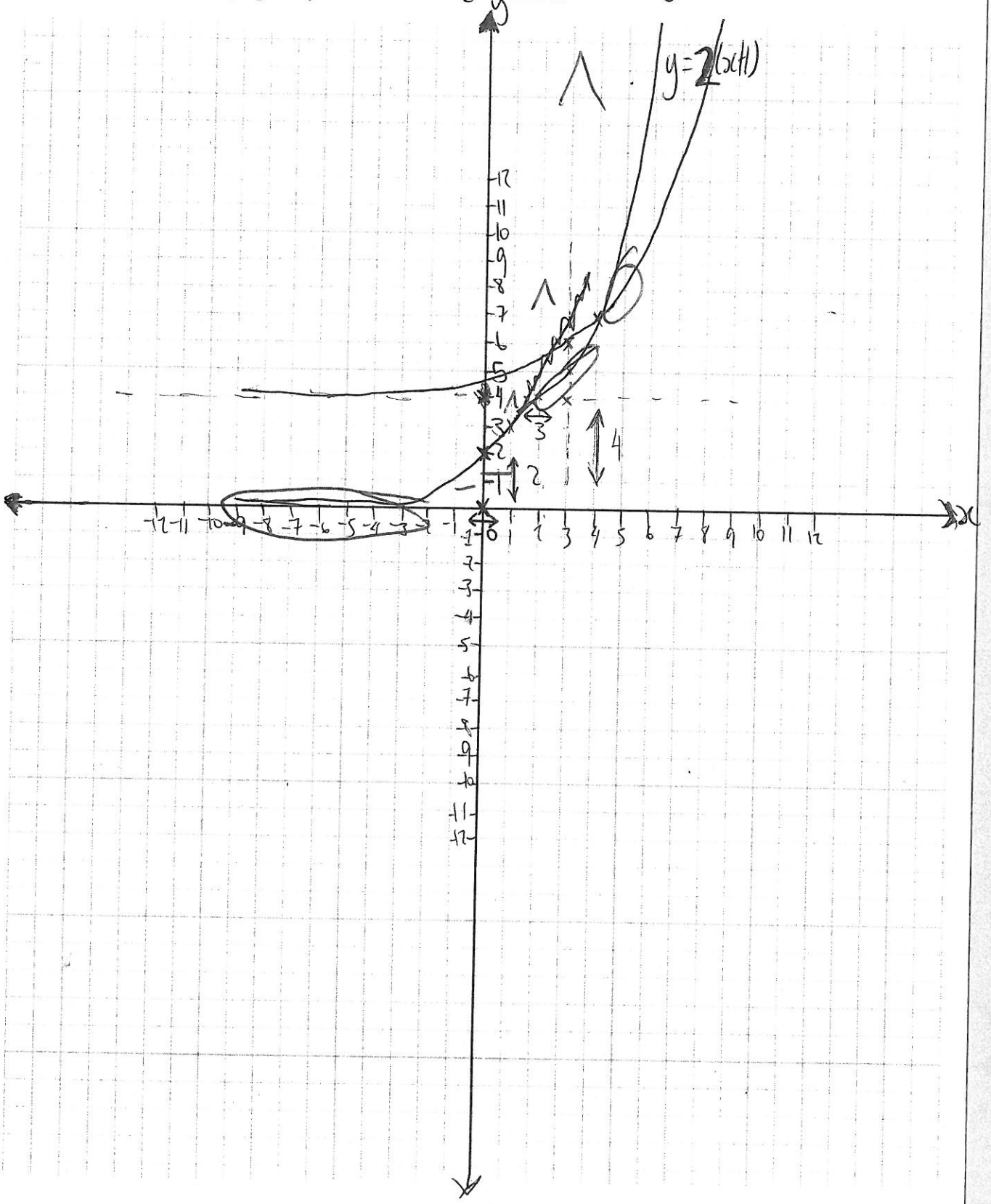
(a) (i) Draw the graph of $y = 2^{(x+1)}$ on the grid below.



(ii) If this graph was moved 3 units to the right and 4 units up, give the equation of the translated graph.

$y = 2^{(x+3)} + 4$

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(b) A stomach bug spreads through a large school.

The **total** number of different students who go to the nurse at least once because of the stomach bug is recorded. Each student's name is recorded only once.

The **total** number of students whose name has been recorded can be modelled by:

$$y = 2^n + 3$$

where n is the number of days since the first students visit the school nurse with the stomach bug.

(i) How many **more** students visited the nurse for the first time on the fourth day than on the third day?

Show your working.

Let S = Students

$y = 2^{(4)} + 3$

$= 16 + 3 = 19$ students (For 4th Day)

$y = 2^{(3)} + 3$

$= 8 + 3 = 11$ students (For 3rd Day)

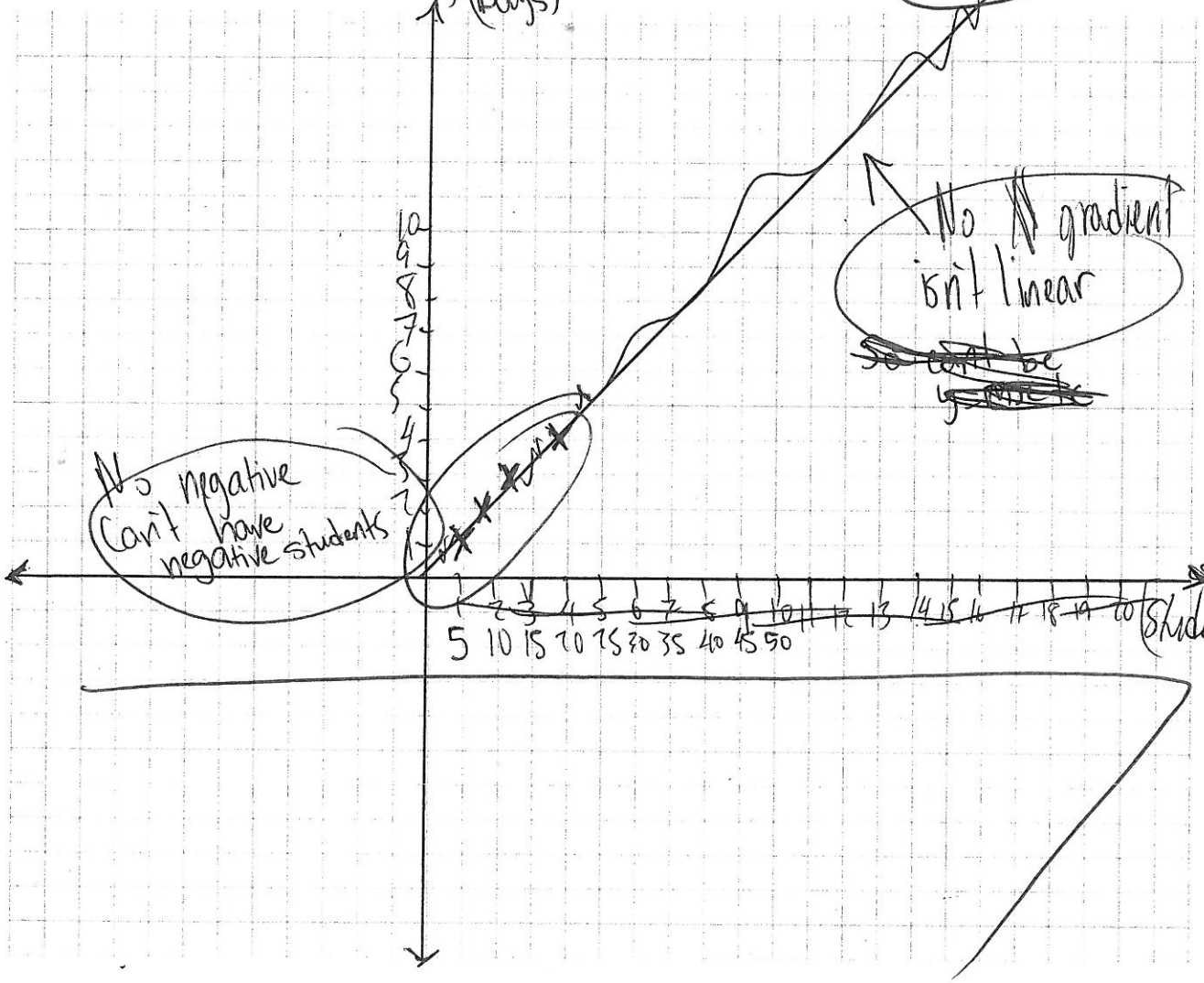
$19 - 11 = 8$ students

∴ 8 more students visited on the 4th Day

(ii) Give the equation that best represents the **number** of students who were recorded as going to the nurse **on any day** n, when $n > 1$.

Give your equation in the simplest form.

Equation: $y = 2^{n>1} + 3$



ASSESSOR'S USE ONLY

(iii) After the **total** number of different students who have visited the nurse reaches 67, the daily number of students who visit begins to decrease.

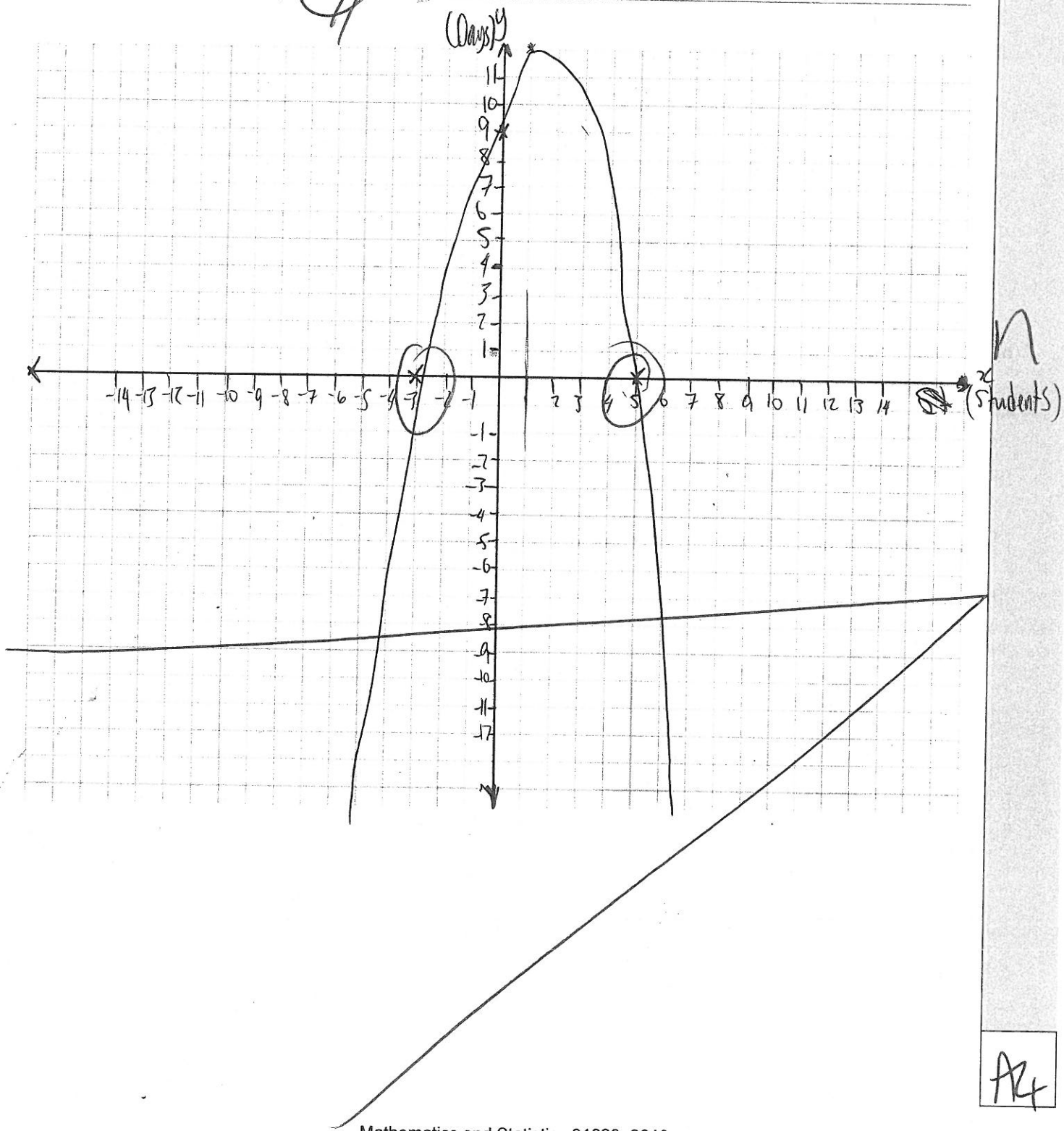
The number of different students going to the nurse can now be modelled by:

$$M = -(x-5)(x+3)+9$$

where x is the number of days after the daily number of students visiting the nurse starts to decrease.

How many days after the first students went to the school nurse with the stomach bug would there be no students going to the school nurse with the same stomach bug?

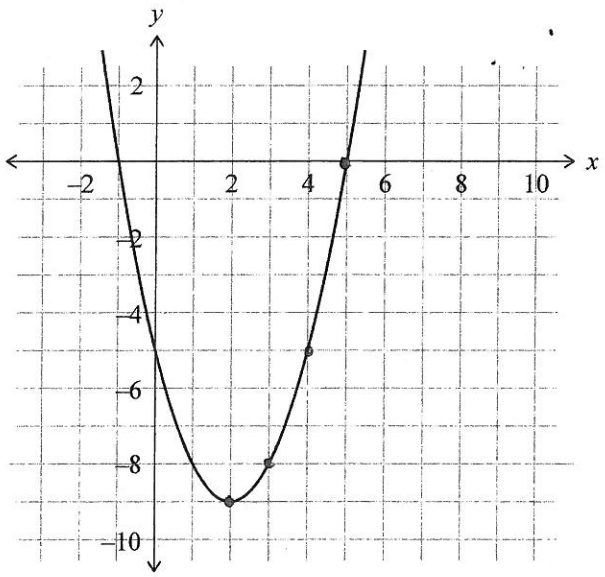
Number of days: 9



QUESTION THREE

ASSESSOR'S USE ONLY

(a) Give the equation of the graph shown below.



Equation: $y = (x+1)(x-5)$

(b) Pippa is designing a new label for a drink bottle.

The design is made up of two circles placed one on top of the other as shown in the diagram.

The maximum height of the two circles is to be 10 cm.

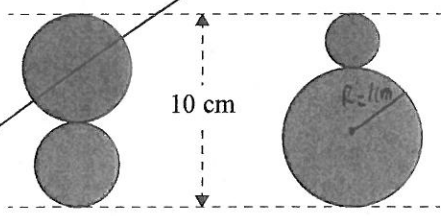
The minimum diameter of either circle is 2 cm (radius is at least 1 cm).

The bottom circle is coloured red and the top one blue.

She wants to know the approximate area of each circle.

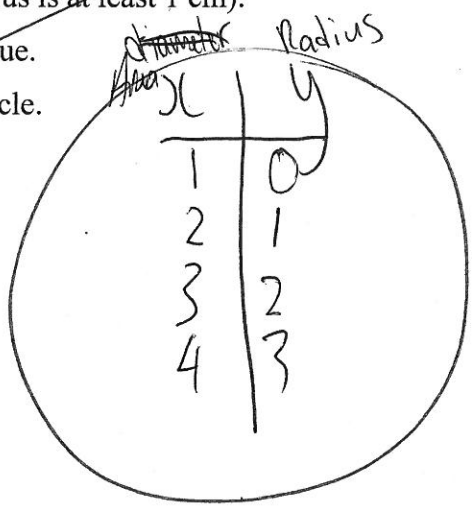
Remember $A = \pi r^2$.

Pippa uses π as 3.



One possible logo design

Another possible logo design



(i) Use a table or graph to investigate the relationship between the area of the red circle and its radius as the radius increases.

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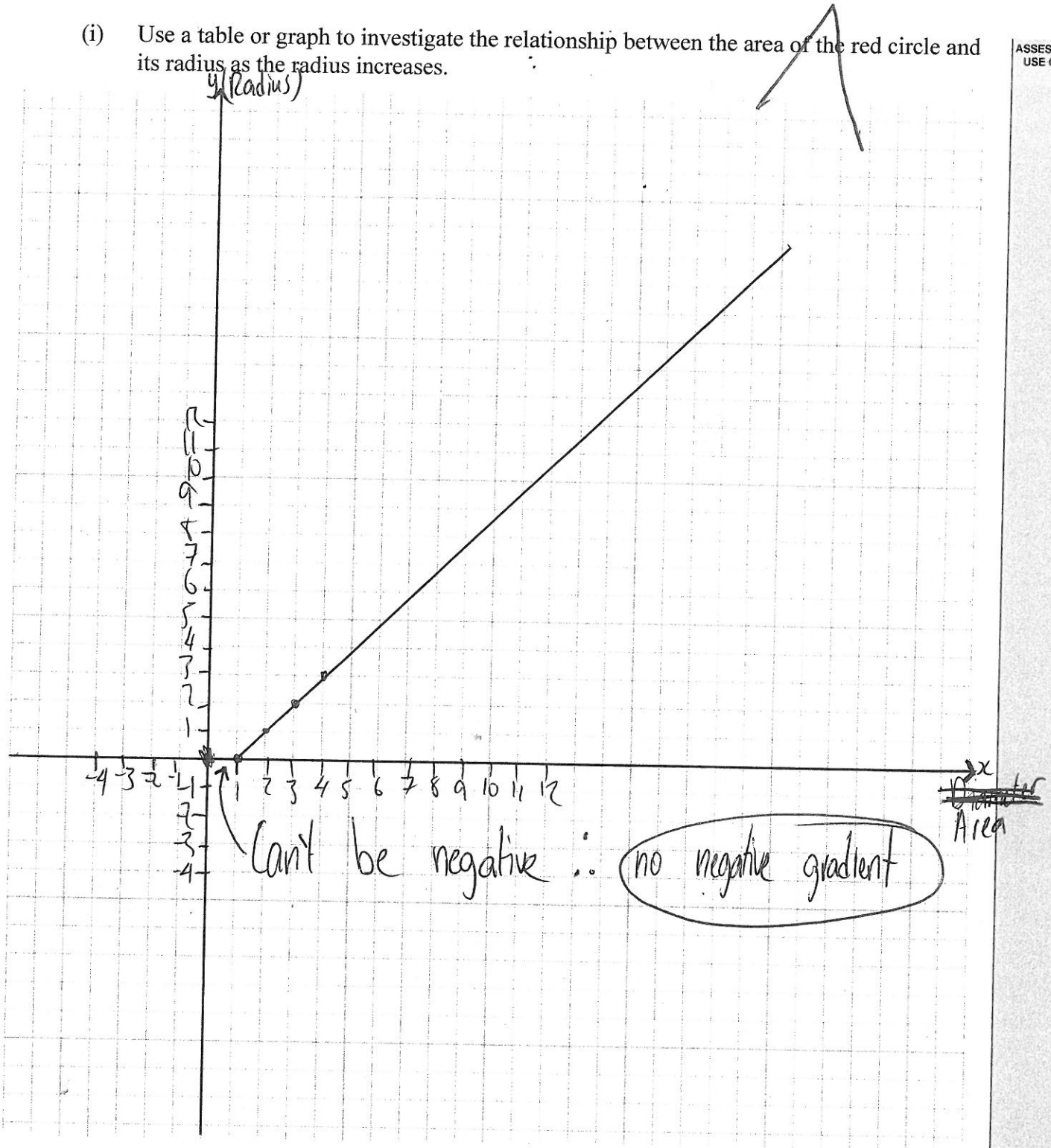

(ii) Describe the major features of the graph that represents the relationship between the area of the red circle and its radius as the radius increases.

Gradient increases when radius increases. ∴ the relationship between area of the red circle and its radius: when radius increases the area of the red circle increases

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(iii) State the equation of the graph that represents the **total** of the areas of the red and the blue circles as the radii change.

(iv) Give the general equation of the graph which represents the **total** of the areas of the red and blue circles, where the sum of their radii is n cm.

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A3

Achievement Exemplar 2018

Subject	Level 1 Mathematics and Statistics	Standard	91028	Total score	10

Q	Grade score	Annotation
1	A3	The candidate successfully found the equation of the line. For a higher achieved or merit the candidate would need to be able to calculate speeds and/or graph the journey for James using a distance/time graph.
2	A4	The candidate successfully worked with an equation to have a vertical translation as well as substituting in to exponential equation to solve a problem. For a merit the candidate would need to solve a quadratic or exponential equation in context.
3	A3	The candidate successfully found the equation of the parabola. For a merit the candidate would need to set up the investigative question with the correct variables in table and comment on their relationship.