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Teaching and Learning

Activity 2

Here are two questions from the June Pure 2 paper

3. (i) Use algebra to prove that for all real values of x

$$(x-4)^2 \geqslant 2x-9$$

(3)

(ii) Show that the following statement is untrue.

$2^n + 1$ is a prime number for all values of n, $n \in \mathbb{N}$

(1)

8. (i) Find the exact solution of the equation

$$8^{2x+1} = 6$$

giving your answer in the form $a + b\log_2 3$, where a and b are constants to be found.

(4)

(ii) Using the laws of logarithms, solve

$$\log_5(7-2y) = 2\log_5(y+1) - 1$$

(5)

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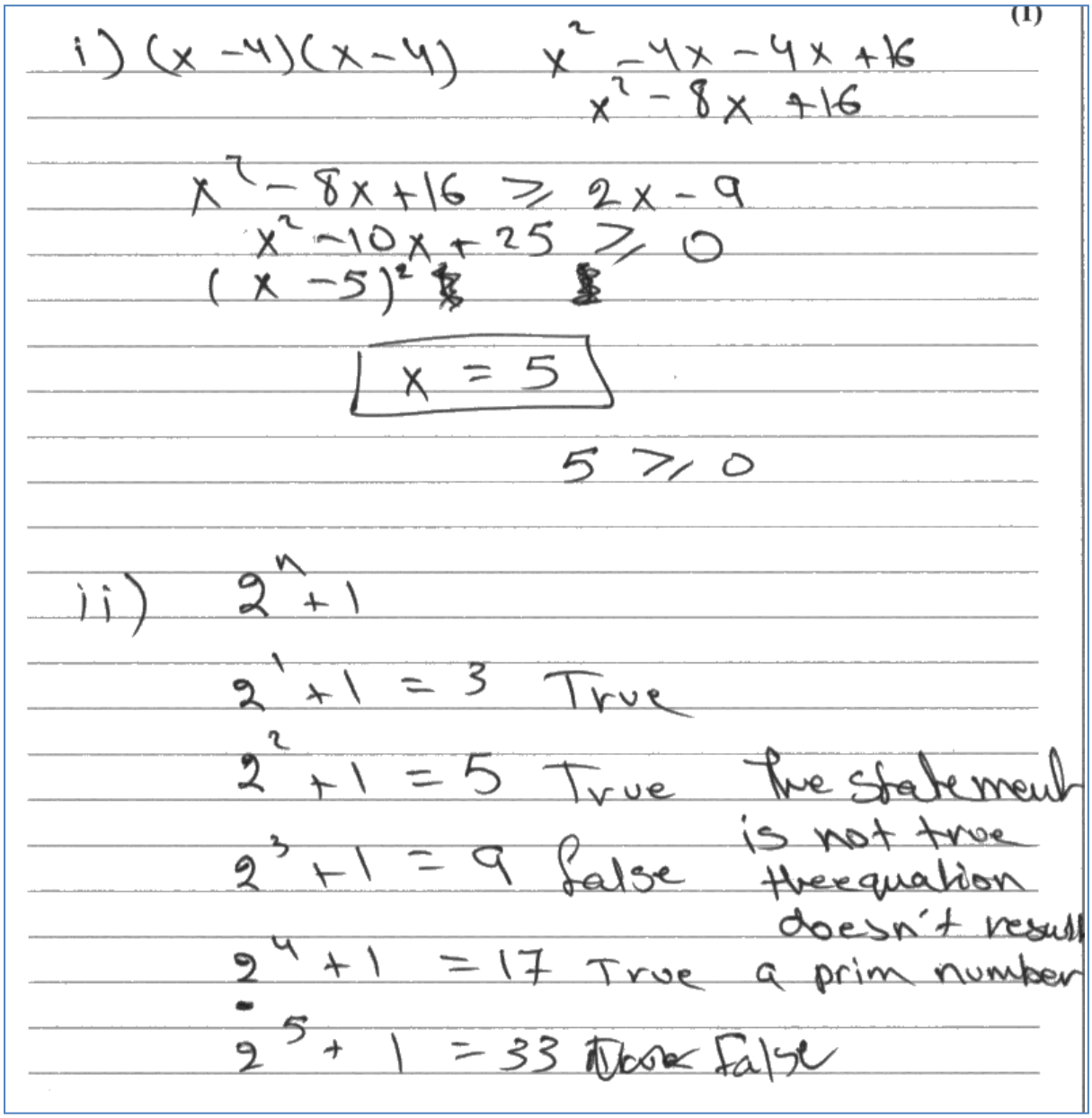
Use the mark scheme to mark the following answers:

A



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B

i) $(x-4)(x-4) \geq 2x-9$

$x^2-4x-4x+16 \geq 2x-9$

$x^2-8x+16 \geq 2x-9$

$-2x \quad +9 \quad -2x \quad +9$

$x^2-10x+25 \geq 0$

$\left(x-\frac{10}{2}\right)^2-\left(\frac{-10}{2}\right)^2+25 \geq 0$

$(x-5)^2-25+25 \geq 0$

$(x-5)^2 \geq 0$

$(x-5)^2$ gives all ways positive value for any number or gives zero if x is zero so all values will be greater or equal to zero.

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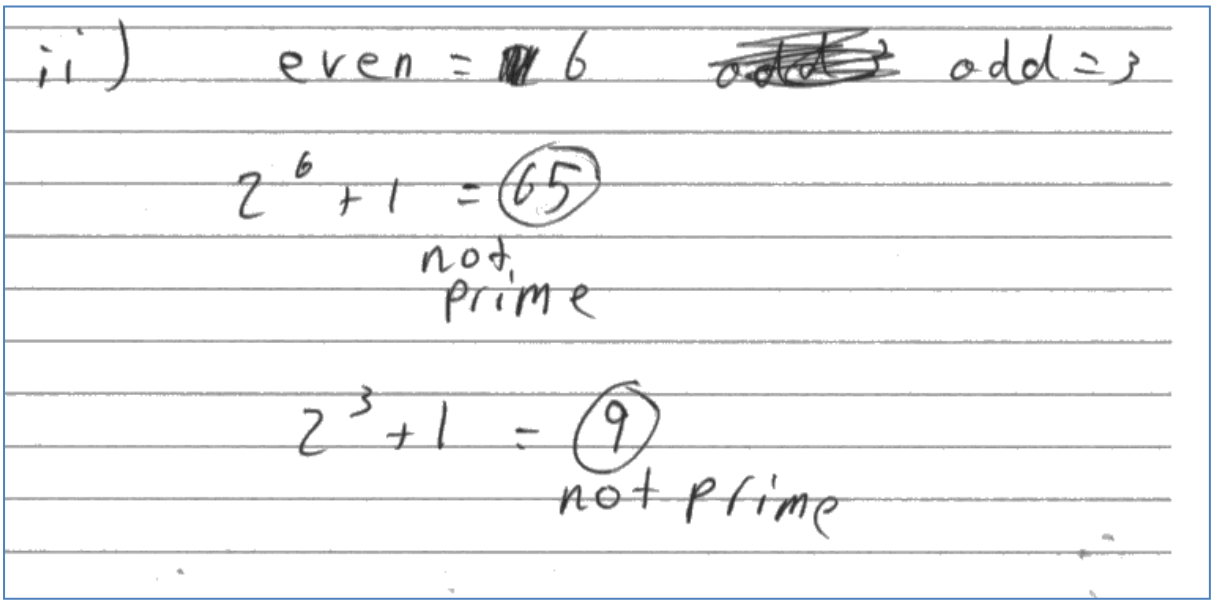
B (cont)



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C

i) $(x-4)(x-4) \geq 2x-9$

$x^2 - 4x - 4x + 16$

$x^2 - 8x + 16 \geq 2x - 9$

$-2x \quad -2x$

$x^2 - 10x + 25 \geqslant 0$

$(x-5)$

$x = 5$ is a real value

all are real route

ii) $2^1 + 1 = 3$

$2^2 + 1 = 5$

the power

when ↑ gives an even number

$(+1)$ gives us the odd

power gives an even number

So the $(+1)$ change it to

an prime number / odd number

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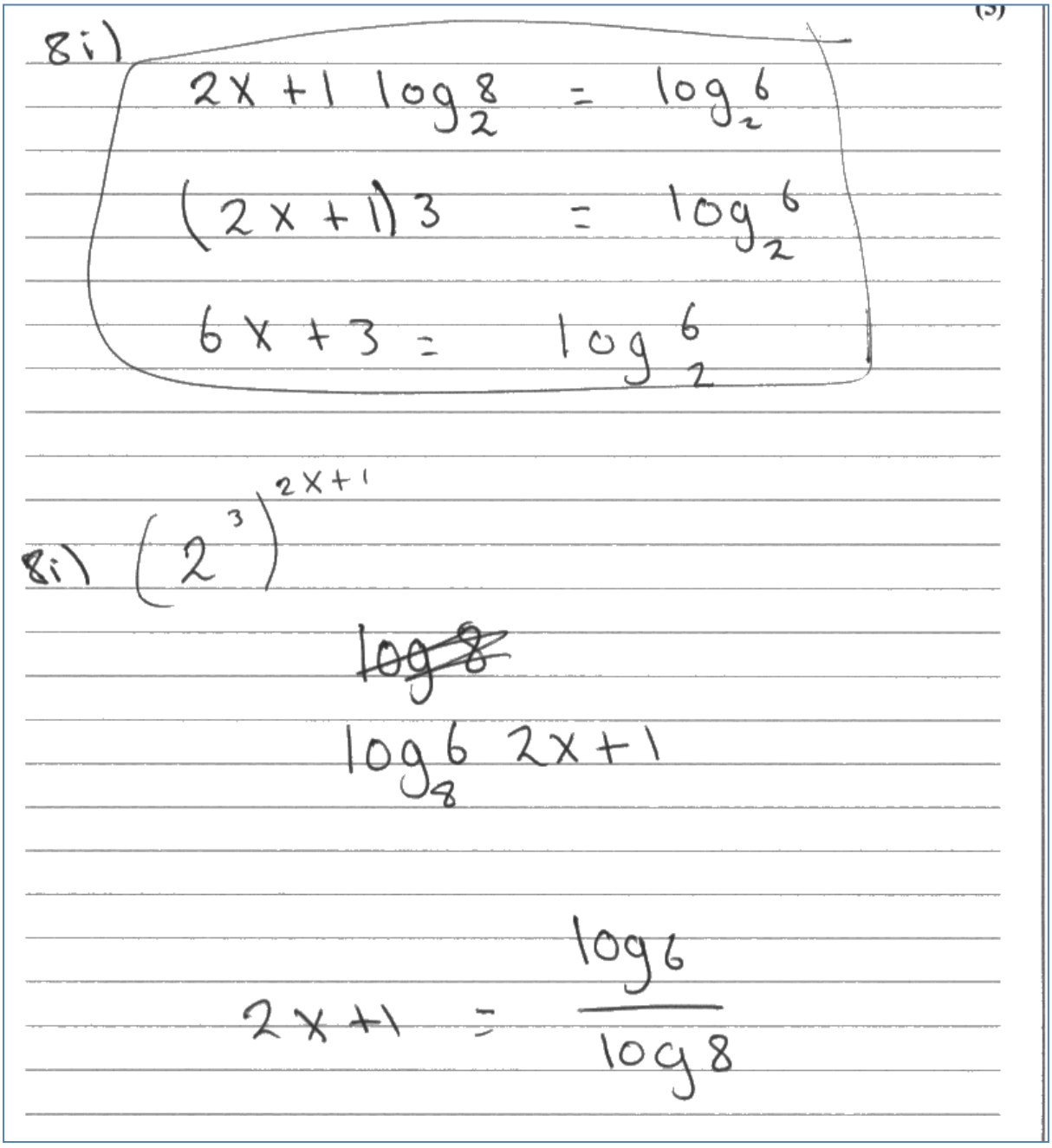
D



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$2x+1 \log_8 8 = \log_2 6$

$2x + 1 + 1 = \log_2 6$

$2x + 2 = \log_2 6$

2

$x + 1 = \log_2 3$

$\frac{\log(2 \times 3)}{\log(2^3)}$ $\quad 1 + \log_2^3$

$\log_2^8$

$\frac{1 + \log^{3}/_{2}}{3}$

$\frac{1}{3} + \log_2^3$

$\boxed{1/3 + \log_2^3}$

$a = 1/3 \quad b = 1$

D

ii) $\log_5(7-2y) = 2\log_5(y+1) - 1$

$$\log_5\left(\frac{7-2y}{(y+1)^2}\right) = -1$$

$$(y+1)(y+1)$$

$$y^2+2y+1$$

$$\frac{1}{5} = \frac{7-2y}{y^2+2y+1}$$

$$y^2+2y+1 = 35-10y$$

$$+10y \qquad -35 \quad +10y$$

$$y^2+12y-34=0$$

~~$y = -6 \pm \sqrt{70}$~~

$$y = -6+\sqrt{70}$$

$$y = -6-\sqrt{70}$$

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E

i) $(2^3)^{2x+1} = \log_2 6$

$6x + 3 = \log_2 6$

$6x + 3 - \log_2 6$

ii) $\log_5(7-2y) = 2\log_5(y+1) - 1$

$\log_5(7-2y) - 2\log_5(y+1)^2 = -1$

$\log_5 \frac{(y+1)^2}{7-2y} = -1$

$\frac{y^2+2y+1}{7-2y} = -1$

$(7-2y) \times -1 = y^2 + 2y + 1$

$-7 + 2y = y^2 + 2y + 1$

$-7 + 2y = y^2 + 2y + 1$

$-2y \quad\quad -2y$

$y^2 + 8$

$y^2 = 8$

$y = 2\sqrt{2} = 2.83$

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F

i. $2^{3(2x+1)} = 6$ $\quad 2^{6x} \times 2^3 = 6$

$2^{6x} = \frac{3}{4}$

$6x \log 2 = \log \frac{3}{4}$

$6x = -0.415$

$x = -0.069$

ii. $\log_5(7-2y) - \log_5(y+1)^2 = -1$

$\log_5\left(\frac{7-2y}{(y+1)^2}\right) = -1$

$\frac{7-2y}{(y+1)^2} = \frac{1}{5}$

$35 - 10y = y^2 + 2y + 1$

$y^2 + 12y - 34 = 0$

$y = -6 \pm \sqrt{70}$

$y = -6 + \sqrt{70}$

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G

i) $(8^2)^x * 8 = 6$ $\quad 8 = 2^3$

$(2^6)^x * 8 = 6$

$(2^6)^x * 2^3 = 6$

$2^{6x+3} = 6$

~~$\log_2 8 = 8x$~~

$\log_2 6 = 6x+3$

$\log_2 2 + \log_2 3 = 6x+3$

~~$3 \log$~~

$1 + \log_2 3 = 6x+3$

$\log_2 3 = 6x+2$

$\log_2 3 - \frac{1}{3}$

6

$\frac{1}{6}\log_2 3 - \frac{1}{18}$

$-\frac{1}{18} + \frac{1}{6}\log_2 3$

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ii) $\log_5 (7-2y) - 2\log_5 (y+1) = -1$

$\log_5 \left(\frac{7-2y}{y^2+2y+1}\right) = -1$

$5^{-1} = \frac{7-2y}{y^2+2y+1}$

$\frac{1}{5}y^2 + \frac{2}{5}y + \frac{1}{5} = 7-2y$

$\frac{1}{5}y^2 + \frac{12}{5} + -\frac{34}{5}$

$\frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$\frac{-\frac{12}{5} \pm \sqrt{\left(\frac{12}{5}\right)^2 - 4 \times \frac{1}{5} \times -\frac{34}{5}}}{2 \times \frac{1}{5}}$

$y = -6+\sqrt{70} = 2.4$

$y = -6-\sqrt{70} = -14.4$ x

$y = 2.4$

because -14.4 is rejected since in $2\log_5(-14.4+1)$ is a math error

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I

5 120 children go on an activity holiday.
The ratio of the number of girls to the number of boys is 3 : 5

On Sunday, all the children either go sailing or go climbing.

$\frac{16}{25}$ of the boys go climbing.

Twice as many girls go sailing as go climbing.

Work out how many children go sailing on Sunday.

3 : 5 = 120
45 : 75

B = $\frac{16}{25}$ of 75 = 48

G = 2 : 1 : 45

G = $\frac{45}{3}$

B = 75 − 48 = 27

G = 30 : 15

27 + 30 = 47

47

(Total for Question 5 is 6 marks)

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J

5 120 children go on an activity holiday.
The ratio of the number of girls to the number of boys is 3 : 5

On Sunday, all the children either go sailing or go climbing.

$\frac{16}{25}$ of the boys go climbing.

Twice as many girls go sailing as go climbing.

Work out how many children go sailing on Sunday.

girls : 3

boys : 5

boy : $\frac{5}{8} \times 120 = 75$

girl : $\frac{3}{8} \times 120 = 45$

boys climb : $\frac{16}{25} \times 75 = 48$

girls = 24

$48 + 24 = 72$

72

(Total for Question 5 is 6 marks)

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K

5 120 children go on an activity holiday.
The ratio of the number of girls to the number of boys is 3 : 5

On Sunday, all the children either go sailing or go climbing.

$\frac{16}{25}$ of the boys go climbing.

Twice as many girls go sailing as go climbing.

Work out how many children go sailing on Sunday.

3+5= 8 → 120 ÷ 8 = 15

15 x 3 = 45 , 15 x 5 = 75

75 ÷ 25 = 3 → +16 = 19

75 - 19 = 56

↓ Sailing (B)

~~3 x 8 = 24~~ ~~÷8=5~~

120 - 56 = 64

÷2 = 32 → $\frac{32}{2}$ = 16

↓ Sailing (G) ↓ Climbing (G)

32 + 56 = 88

88

(Total for Question 5 is 6 marks)