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13  $a = \sqrt{8} + 4$

$b = \sqrt{8} - 4$

$(a - b)(a + b)$  can be written in the form  $y\sqrt{4y}$

Find the value of  $y$

Show your working clearly.

$$\begin{aligned} a - b &= \sqrt{8} + 4 - (\sqrt{8} - 4) \\ &= \sqrt{8} + 4 - \sqrt{8} + 4 \\ &= 8 \end{aligned}$$

$$\begin{aligned} a + b &= \sqrt{8} + 4 + (\sqrt{8} - 4) \\ &= \sqrt{8} + 4 + \sqrt{8} - 4 \\ &= 2\sqrt{8} \end{aligned}$$

$$\begin{aligned} (a - b)(a + b) &= (8)(2\sqrt{8}) \\ &= 8 \times 2\sqrt{8} \end{aligned}$$

$y = \dots\dots\dots$

(Total for Question 13 is 3 marks)

$$= 8 \times \sqrt{4 \times 8}$$

$$k = 8$$



P 6 8 7 2 9 A 0 1 7 3 2

17 Given that  $8\sqrt{m} + \sqrt{49m} - \sqrt{9m} = k\sqrt{m}$   
 where  $k$  is an integer and  $m$  is a prime number,

(a) work out the value of  $k$

$$8\sqrt{m} + \sqrt{49m} - \sqrt{9m} = k\sqrt{m}$$

$$8\sqrt{m} + 7\sqrt{m} - 3\sqrt{m} = k\sqrt{m}$$

$$12\sqrt{m} = k\sqrt{m}$$

$$k = 12$$

$k = \dots\dots\dots$  (1)

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17 (a) Show that  $(6 + 2\sqrt{12})^2 = 12(7 + 4\sqrt{3})$

Show each stage of your working.

$$\begin{aligned}
 & (6 + 2\sqrt{12})(6 + 2\sqrt{12}) \\
 &= 36 + 6 \times 2\sqrt{12} + 6 \times 2\sqrt{12} + 2\sqrt{12} \times 2\sqrt{12} \\
 &= 36 + 12\sqrt{12} + 12\sqrt{12} + 4\sqrt{144} \\
 &= 36 + 24\sqrt{12} + 48 \\
 &= 84 + 24\sqrt{12} \\
 &= 84 + 24\sqrt{4}\sqrt{3} \\
 &= 84 + 24 \times 2 \times \sqrt{3} \\
 &= 84 + 48\sqrt{3} \\
 &= 12(7 + 4\sqrt{3})
 \end{aligned}$$

(3)



P 5 9 7 5 6 A 0 2 1 2 8

17 (a) Express  $\sqrt{675}$  in the form  $n\sqrt{27}$  where  $n$  is a positive integer.

$$\begin{aligned}\sqrt{675} &= \sqrt{25 \times 27} \\ &= \sqrt{25} \times \sqrt{27} \\ &= 5\sqrt{27}\end{aligned}$$

(1)

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- 18 Given that  $(8 - \sqrt{x})(5 + \sqrt{x}) = y\sqrt{x} + 21$  where  $x$  is a prime number and  $y$  is an integer, find the value of  $x$  and the value of  $y$ . Show each stage of your working clearly.

$$(8 - \sqrt{x})(5 + \sqrt{x})$$

$$40 + 8\sqrt{x} - 5\sqrt{x} - \sqrt{x}\sqrt{x}$$

$$40 + 3\sqrt{x} - x$$

$$40 - x + 3\sqrt{x}$$

$$21 + y\sqrt{x}$$

$$40 - x = 21$$

$$x = 19$$

$$y = 3$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

(Total for Question 18 is 3 marks)



P 6 6 2 9 7 A 0 2 1 2 8

# January 2023 Paper1HR

18 Solve  $\sqrt{3}(x - 2\sqrt{3}) = x + 2\sqrt{3}$

Give your answer in the form  $a + b\sqrt{3}$  where  $a$  and  $b$  are integers.  
Show your working clearly.

$$\sqrt{3}(x - 2\sqrt{3}) = x + 2\sqrt{3}$$

$$x\sqrt{3} - 2\sqrt{3}\sqrt{3} = x + 2\sqrt{3}$$

$$x\sqrt{3} - 2 \times \sqrt{9} = x + 2\sqrt{3}$$

$$x\sqrt{3} - 2 \times 3 = x + 2\sqrt{3}$$

$$x\sqrt{3} - 6 = x + 2\sqrt{3}$$

$$x\sqrt{3} = 6 + x + 2\sqrt{3}$$

$$x\sqrt{3} - x = 6 + 2\sqrt{3}$$

$$x(\sqrt{3} - 1) = 6 + 2\sqrt{3}$$

$$x = \frac{6 + 2\sqrt{3}}{\sqrt{3} - 1}$$

$x =$  .....

(Total for Question 18 is 4 marks)

$$x = \frac{6 + 2\sqrt{3}}{-1 + \sqrt{3}}$$

$$= \frac{6 + 2\sqrt{3}}{-1 + \sqrt{3}} \times \frac{-1 - \sqrt{3}}{-1 - \sqrt{3}} = \frac{-6 - 6\sqrt{3} - 2\sqrt{3} - 2\sqrt{9}}{1 + \sqrt{3} - \sqrt{3} - \sqrt{9}}$$

$$= \frac{-6 - 8\sqrt{3} - 6}{1 - 3}$$

$$= \frac{-12 - 8\sqrt{3}}{-2} = 6 + 4\sqrt{3}$$



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23 Simplify  $\frac{30 \times 25^{2x+7}}{\sqrt{180} \times (\sqrt{5})^{4x+9}}$

Give your answer in the form  $5^w$  where  $w$  is an expression in terms of  $x$   
 Show each stage of your working clearly.

$$\begin{aligned} \frac{30 \times 25^{2x+7}}{\sqrt{180} \times (\sqrt{5})^{4x+9}} &= \frac{5 \times 6 \times (5^2)^{2x+7}}{\sqrt{36 \times 5} \times (5^{\frac{1}{2}})^{4x+9}} \\ &= \frac{5 \times 6 \times 5^{4x+14}}{6 \times \sqrt{5} \times 5^{2x+4.5}} \\ &= \frac{5^1 \times 5^{4x+14}}{5^{\frac{1}{2}} \times 5^{2x+4.5}} \\ &= \frac{5^{4x+15}}{5^{2x+5}} \\ &= 5^{4x+15} \div 5^{2x+5} \\ &= 5^{4x+15-(2x+5)} \\ &= 5^{2x+10} \end{aligned}$$

(Total for Question 23 is 3 marks)



P 7 3 9 9 4 A 0 2 3 2 8