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1. Simplify

(a) $(2\sqrt{5})^2$ (1)

(b) $\frac{\sqrt{2}}{2\sqrt{5} - 3\sqrt{2}}$ giving your answer in the form $a + \sqrt{b}$, where a and b are integers. (4)



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Question 1 continued

Lined area for writing the answer to Question 1.

(Total 5 marks)

Q1



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Question 2 continued

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(Total 7 marks)

Q2



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Question 3 continued

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(Total 6 marks)

Q3



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4. (i) A sequence U_1, U_2, U_3, \dots is defined by

$$U_{n+2} = 2U_{n+1} - U_n, \quad n \geq 1$$

$$U_1 = 4 \text{ and } U_2 = 4$$

Find the value of

(a) U_3

(1)

(b) $\sum_{n=1}^{20} U_n$

(2)

(ii) Another sequence V_1, V_2, V_3, \dots is defined by

$$V_{n+2} = 2V_{n+1} - V_n, \quad n \geq 1$$

$$V_1 = k \text{ and } V_2 = 2k, \text{ where } k \text{ is a constant}$$

(a) Find V_3 and V_4 in terms of k .

(2)

Given that $\sum_{n=1}^5 V_n = 165,$

(b) find the value of k .

(3)



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Question 4 continued

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(Total 8 marks)

Q4

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5. The equation

$$(p - 1)x^2 + 4x + (p - 5) = 0, \text{ where } p \text{ is a constant}$$

has no real roots.

(a) Show that p satisfies $p^2 - 6p + 1 > 0$ (3)

(b) Hence find the set of possible values of p . (4)



6. The curve C has equation

$$y = \frac{(x^2 + 4)(x - 3)}{2x}, \quad x \neq 0$$

(a) Find $\frac{dy}{dx}$ in its simplest form.

(5)

(b) Find an equation of the tangent to C at the point where $x = -1$

Give your answer in the form $ax + by + c = 0$, where a , b and c are integers.

(5)



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Question 6 continued

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Question 6 continued

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Q6

(Total 10 marks)



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7. Given that $y = 2^x$,

(a) express 4^x in terms of y .

(1)

(b) Hence, or otherwise, solve

$$8(4^x) - 9(2^x) + 1 = 0$$

(4)



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Question 8 continued



P 4 3 1 4 5 A 0 2 1 3 2

9. Jess started work 20 years ago. In year 1 her annual salary was £17000. Her annual salary increased by £1500 each year, so that her annual salary in year 2 was £18500, in year 3 it was £20000 and so on, forming an arithmetic sequence. This continued until she reached her maximum annual salary of £32000 in year k . Her annual salary then remained at £32000.

(a) Find the value of the constant k . (2)

(b) Calculate the total amount that Jess has earned in the 20 years. (5)



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Question 9 continued



P 4 3 1 4 5 A 0 2 5 3 2

10. A curve with equation $y = f(x)$ passes through the point $(4, 9)$.

Given that

$$f'(x) = \frac{3\sqrt{x}}{2} - \frac{9}{4\sqrt{x}} + 2, \quad x > 0$$

(a) Find $f(x)$, giving each term in its simplest form. (5)

Point P lies on the curve.

The normal to the curve at P is parallel to the line $2y + x = 0$

(b) Find the x coordinate of P . (5)



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Question 10 continued

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Question 10 continued

Lined area for writing the answer to Question 10.

(Total 10 marks)

Q10

TOTAL FOR PAPER: 75 MARKS

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