



St Catherine's School

Year: 11

Subject: Mathematics

Time Allowed: 55 minutes

Date: 24 February 2005

Instructions

- All questions are to be attempted.
- Marks may be deducted for careless or badly presented work.
- Answer all questions on the blank sheets provided.
- Start a new page for each section.
- Show all your working.

GOOD LUCK ☺

TEACHER'S USE ONLY	
Total Marks	
Section A Q1, 2 & 3	/18
Section B Q 4 & 5	/21
Section C Q 6, 7, 8 & 9	/18
TOTAL	/57

NAME: _____
TEACHER: _____

SECTION A (START A NEW PAGE)

MARKS

Question 1: Use your calculator to evaluate

$$\sqrt{\frac{(8.1)^2}{4.13 + 5.46}}$$

Write your answer correct to

- | | | |
|------|---------------------|---|
| (i) | 2 decimal places | 2 |
| (ii) | the nearest integer | 1 |

Question 2: Expand and simplify the following

- | | | |
|-------|----------------------|---|
| (i) | $(2m + 4) - (m - 2)$ | 1 |
| (ii) | $3 - 6(x - 6) - 2$ | 1 |
| (iii) | $(2y + 4)(3y - 1)$ | 1 |

Question 3: Factorise the following fully.

- | | | |
|--------|-------------------------|-----|
| (i) | $(m - n)r - (m - n)s$ | 1 |
| (ii) | $9 - t^2$ | 1 |
| (iii) | $5x^2 + 6x + 1$ | 1.5 |
| (iv) | $2pq - pr + 6q^2 - 3qr$ | 1.5 |
| (v) | $x^3 + 27$ | 1.5 |
| (vi) | $125a^3 - 8b^3$ | 1.5 |
| (vii) | $x^3 - x^2 - 4x + 4$ | 2 |
| (viii) | $x^2 + 6x + 9 - 16y^2$ | 2 |

SECTION B (START A NEW PAGE)

MARKS

Question 4: Simplify the following algebraic fractions.

(i) $\frac{m^2 + 2m - 8}{m^2 - 4}$ 2

(ii) $\frac{(a+b)^2 - c^2}{3a + 3b - 3c}$ 2

(iii) $\frac{m^2 - mn}{n^2 - n} \times \frac{1 - n}{m - n}$ 3

(iv) $\frac{y}{x^2 - xy} + \frac{1}{x}$ 3

(v) $\frac{3}{x-2} - \frac{5}{x-1}$ 2

(vi) $\frac{x^2 + x - 6}{x^3} \div \frac{x^2 - 4}{x}$ 3

(v) $\frac{x-6}{x^2 - x - 6} - \frac{x+3}{x^2 + 8x + 12}$ 3

Question 5: In the formula $N = \frac{A}{(1+r)^n}$, find the value of r , correct to 1 significant figure, if $N = 5000$, $A = 9000$ and $n = 3$.

3

SECTION C (START A NEW PAGE)

MARKS

Question 6: Solve the following equations

(i) $\frac{x-3}{4} = \frac{x-1}{12} + 5$ 3

(ii) $\frac{3x+1}{4x-3} = \frac{3x+9}{4x-1}$ 2

(iii) $\sqrt[3]{5m-2} = 2$ 2

Question 7: Use the quadratic formula to solve the following quadratic equation. 3

$$15 - 2m - m^2 = 0$$

Question 8: Solve the following equations simultaneously. 4

$$9x - 5y = 6$$

$$3x - 4y = 9$$

Question 9: Solve the quadratic equation below, using the method of completing the square. Leave your answer correct to 2 decimal places. 4

$$x^2 + 8x + 11 = 0$$

END OF TASK

Solutions

~~✓~~ means 1 mark
~~✗~~ means 1/2 mark

Q1 - (i) 2.615626... ✓
 2 decimal places → 2.62 ✓
 (ii) nearest integer → 3 ✓

always show what the calculator displays, as you may awarded marks for correct rounding off

Q2 - (i) $(2m+4) - (m-2)$
 $= 2m+4 - m + 2$ ✓
 $= m+6$ ✓

(ii) $3 - 6(x-6) - 2$
 $= 3 - 6x + 36 - 2$ ✓
 $= 37 - 6x$ ✓

(iii) $(2y+4)(3y-1)$
 $= 6y^2 - 2y + 12y - 4$ ✓
 $= 6y^2 + 10y - 4$ ✓

- 1/2 mark if the solution continues by factorising

Q3 - (i) $(m-n)r - (m-n)s$
 $= (m-n)(r-s)$ ✓

(ii) $9 - t^2$
 $= (3-t)(3+t)$ ✓

(ii) $5x^2 + 6x + 1$
 $= (5x+1)(x+1)$ ✓

(iv) $2pq - pr + 6q^2 - 3qr$
 $= p(2q-r) + 3q(2q-r)$ ✓
 $= (2q-r)(p+3q)$ ✓

(v) $x^3 + 27$
 $= (x+3)(x^2 - 3x + 9)$

(vi) $125a^3 - 8b^3$
 $= (5a)^3 - (2b)^3$ ✓
 $= (5a-2b)(25a^2 + 10ab + 4b^2)$ ✓

(vii) $x^3 - x^2 - 4x + 4$
 $= x^2(x-1) - 4(x-1)$ ✓
 $= (x^2-4)(x-1)$ ✓
 $= (x-2)(x+2)(x-1)$ ✓

(viii) $x^2 + 6x + 9 - 16y^2$
 $= (x+3)^2 - 16y^2$ ✓
 $= (x+3-4y)(x+3+4y)$ ✓

$$\text{Q4 (i) } \frac{m+2m-8}{m^2-4}$$

$$= \frac{(m+4)(\cancel{m-2})}{(\cancel{m-2})(m+2)} \checkmark$$

$$= \frac{m+4}{m+2} \checkmark$$

1/2

$$\text{(ii) } \frac{(a+b)^2 - c^2}{3a+3b-3c}$$

$$= \frac{(a+b-c)(\cancel{a+b+c})}{3(\cancel{a+b+c})}$$

$$= \frac{a+b+c}{3}$$

1/2

$$\text{(iii) } \frac{m^2-mn}{n^2-n} \times \frac{1-n}{m-n}$$

$$= \frac{m(\cancel{m-n})}{n(n-1)} \times \frac{1-n}{\cancel{m-n}} \checkmark$$

$$= \frac{m}{n(n-1)} \times \frac{-(n-1)}{1} \checkmark$$

$$= -\frac{m}{n} \checkmark$$

1/3

$$\text{(iv) } \frac{y}{x^2-xy} + \frac{1}{x}$$

$$= \frac{y}{x(x-y)} + \frac{1}{x} \checkmark$$

$$= \frac{y+1(x-y)}{x(x-y)} \checkmark$$

$$= \frac{\cancel{x}}{\cancel{x}(x-y)} \checkmark$$

$$= \frac{1}{x-y}$$

1/3

$$\text{(v) } \frac{3}{x-2} - \frac{5}{x-1}$$

$$= \frac{3(x-1) - 5(x-2)}{(x-2)(x-1)} \checkmark$$

$$= \frac{3x-3-5x+10}{(x-2)(x-1)} \checkmark$$

$$= \frac{7-2x}{(x-2)(x-1)} \checkmark$$

1/2

$$Q4 - (vi) \frac{x^2+x-6}{x^3} \div \frac{x^2-4}{x}$$

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

$$= \frac{(x+3)(x-2)}{x^2 x^2} \times \frac{x^1}{(x-2)(x+2)} \checkmark \checkmark$$

$$= \frac{x+3}{x^2(x+2)}$$

1/3

$$(vii) \frac{x-6}{x^2-x-6} - \frac{x+3}{x^2+8x+12}$$

$$= \frac{x-6}{(x-3)(x+2)} - \frac{x+3}{(x+6)(x+2)} \checkmark$$

$$= \frac{(x-6)(x+6) - (x+3)(x-3)}{(x-3)(x+2)(x+6)} \checkmark$$

$$= \frac{x^2-36 - (x^2-9)}{(x-3)(x+2)(x+6)} \checkmark$$

$$= \frac{\cancel{x^2} - 36 - \cancel{x^2} + 9}{(x-3)(x+2)(x+6)} \checkmark$$

$$= \frac{-27}{(x-3)(x+2)(x+6)} \checkmark$$

1/3

$$Q5. N = \frac{A}{(1+r)^n}$$

$$5000 = \frac{9000}{(1+r)^3} \checkmark$$

$$5000(1+r)^3 = 9000$$

$$(1+r)^3 = \frac{9000}{5000} \checkmark$$

$$\sqrt[3]{(1+r)^3} = \sqrt[3]{\frac{9}{5}}$$

$$1+r = \sqrt[3]{\frac{9}{5}} \checkmark$$

$$\therefore r = \sqrt[3]{\frac{9}{5}} - 1 \checkmark$$

$$r = 0.21644 \dots$$

$$r = 0.2 \text{ (to 1 sig. fig.)} \checkmark$$

$$Q6. (i) \frac{x-3}{4} = \frac{x-1}{12} + 5$$

$$\frac{3(x-3) = 1(x-1) + 60}{12} \checkmark$$

$$3x-9 = x-1+60 \checkmark$$

$$3x-x = 59+9 \checkmark$$

$$2x = 68 \checkmark$$

$$\therefore x = 34 \checkmark$$

1/3

$$Q6 (i) \frac{3x+1}{4x-3} = \frac{3x+7}{4x-1}$$

$$(3x+1)(4x-1) = (3x+7)(4x-3) \quad \checkmark$$

$$12x^2 - 3x + 4x - 1 = 12x^2 - 9x + 36x - 27 \quad \checkmark$$

$$12x^2 + x - 1 = 12x^2 + 27x - 27$$

$$x - 27x = -27 + 1$$

$$-26x = -26 \quad \checkmark$$

$$\therefore x = 1 \quad \checkmark$$

$$(ii) \sqrt[3]{5m-2} = 2$$

$$5m-2 = 2^3 \quad \checkmark$$

$$5m = 8 + 2 \quad \checkmark$$

$$5m = 10$$

$$\therefore m = 2 \quad \checkmark$$

$$Q7. m = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\left. \begin{array}{l} a = -1 \\ b = -2 \\ c = 15 \end{array} \right\} = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(-1)(15)}}{-2} \quad \checkmark$$

$$= \frac{2 \pm \sqrt{4+60}}{-2} \quad \checkmark$$

$$= \frac{2 \pm \sqrt{64}}{-2}$$

$$= \frac{2 \pm 8}{-2} \quad \checkmark$$

$$= \frac{1 \pm 4}{-1}$$

$$= -1 \pm 4 = -5 \text{ OR } 3 \quad \checkmark \quad \checkmark$$

$$Q8 - \begin{cases} 4x - 5y = 6 & \text{--- (1) } \times 3 \\ 3x - 4y = 9 & \text{--- (2) } \times 9 \end{cases} \quad \checkmark$$

$$9x - 5y = 6 \quad \text{--- (1)}$$

$$9x - 12y = 27 \quad \text{--- (2)}$$

$$\text{--- (3) --- (1)} \quad -7y = 21 \quad \checkmark$$

$$y = -3 \quad \checkmark$$

$$27x - 15y = 18 \quad \text{--- (1)'} \quad \checkmark$$

$$27x - 36y = 81 \quad \text{--- (2)'} \quad \checkmark$$

$$21y = -63 \quad \checkmark$$

$$\therefore y = \frac{-63}{21} \quad \checkmark$$

$$\boxed{y = -3} \quad \checkmark$$

$$9x - 5y = 6$$

$$9x - 5(-3) = 6$$

$$9x + 15 = 6 \quad \checkmark$$

$$9x = 6 - 15 \quad \checkmark$$

$$9x = -9$$

$$\therefore \boxed{x = -1} \quad \checkmark$$

$$Q9 - x^2 + 8x + 11 = 0$$

$$x^2 + 8x + ? = -11 \quad \checkmark$$

$$x^2 + 8x + 4^2 = -11 + 4^2 \quad \checkmark$$

$$(x+4)^2 = 5 \quad \checkmark$$

$$\sqrt{(x+4)^2} = \pm \sqrt{5} \quad \checkmark$$

$$x+4 = \pm \sqrt{5} \quad \checkmark$$

$$\therefore x = -4 \pm \sqrt{5} \quad \checkmark$$

$$x = -1.76 \text{ OR } -6.24 \quad \checkmark$$