

CHELTENHAM GIRLS HIGH SCHOOL



YEAR 11
MARCH 2011

MATHEMATICS

COMMON TEST ONE

Time allowed : 40 minutes

DIRECTIONS TO CANDIDATES

- Attempt all questions.
- Write your name on each page.
- All necessary working should be shown in every question.
- Calculators are permitted.
- Start each Question on a **new page**.
- Answers are to be completed in blue or black pen.
- Write on one side of the page only.

Name : _____ Class Teacher _____

Question 1	Question 2	Question 3	Question 4	Total	%
/11	/10	/11	/12	/44	

Question 1 (Start on a new page) (11 marks)

Marks

- (a) Evaluate $\frac{6.725}{5.27 \times 4.12}$ to 4 decimal places. 1
- (b) Write 5.2×10^{-4} as an ordinary numeral. 1
- (c) Evaluate $7.52 \times 10^4 \times 3.24 \times 10^{-3}$, giving your answer in scientific notation rounded to 2 decimal places. 2
- (d) Given that $r = \sqrt{\frac{V}{\pi h}}$, find the value of r when $V = 20$ and $h = 5.2$, give your answer to 4 significant figures. 2
- (e) If $x = \frac{1}{2}$, $y = \frac{1}{4}$ and $z = \frac{1}{5}$, find $\sqrt[3]{\frac{3xy}{z}}$ to 2 decimal places. 2
- (f) Write $0.5\dot{2}$ as a fraction. Show all working. 3

Question 2 (Start on a new page) (10 marks)

Marks

- (a) A worker on \$398.50 per week was offered a new wage of \$406.95 per week. What percentage increase is this? Answer to 2 decimal places.

2

(b) Simplify:

(i) $5a^2b \times 3ab^2$

2

(ii) $(-4y)^3$

2

(iii) $32xy^2 \div 16x^2y$

2

(iv) $\frac{5x^2y}{4y^3z} \times \frac{z^2}{4x^3} \div \frac{10xz}{16y^2}$

2

Question 3 (Start on a new page) (11 marks)

Marks

(a) Subtract $(2x + y - 10)$ from $(x - 4y + 7)$

1

(b) Fully expand and simplify:

(i) $8a - 4(2a - b)$

2

(ii) $3(2y - 4) - 5(7 - 2y)$

2

(iii) $(2a-3)(2a+3)$

1

(iv) $(x - 3)(2x^2 + 2x - 1)$

2

(v) $(2a + 7)^2$

1

(vi) $(6a - b)(5a + 2b)$

2

Question 4 (Start on a new page) (12 marks)

Fully factorise the following:

(i) $4a + 2ax - 4b - 2bx$

2

(ii) $27 - x^3$

2

(iii) $x^2 + 10x + 25$

1

(iv) $3x^2 - 17x + 20$

2

(v) $2x^3 + 16$

2

(vi) $y^3 - 3y^2 - 4y + 12$

3

End of paper

5 (a) Simplify $\frac{x^2-x-6}{x(x+2)} \div \frac{x^2-9}{9}$

(b) Simplify $\frac{1}{a^2-a} + \frac{1}{a^2+a}$

(c) Simplify $\frac{1-x^{-1}}{x^{-2}-x^{-1}}$

(d) Simplify $\sqrt{16x^2y^2(y^2 + 8y + 16)}$

(e) Simplify $\frac{2}{2+\sqrt{2}} + \frac{4}{2\sqrt{2}}$

(f) If $a + \frac{1}{a} = 5$, find $a^2 + \frac{1}{a^2}$

(g) Find the maximum value of $y = 9 + 6x - x^2$

Q.11
① (a) 0.3097

(b) 0.00052

(c) 243.648
 $\approx 2.44 \times 10^2$ (2 dp)

(d) $r = \sqrt{\frac{20}{\pi \times 5.2}}$
 $= 1.10646\dots$
 ≈ 1.106 (4 s.f.)

(e) $\frac{3xy}{z} = \frac{3 \times \frac{1}{2} \times \frac{1}{4}}{\frac{1}{5}}$
 $= 1\frac{7}{8}$
 $\sqrt[3]{\frac{3xy}{z}} = 1.233\dots$
 ≈ 1.23
(2 dp)

(f) Let $x = 0.5222\dots$
 $10x = 5.222\dots$
 $100x = 52.222\dots$
 $90x = 47$
 $x = \frac{47}{90}$

② (a)

Increase = $\$406.95 - \398.50
 $= \$8.45$

% increase = $\frac{8.45}{398.50} \times 100\%$
 $= 2.12\%$

(b) (i) $5a^2b \times 3ab^2 = 15a^3b^3$

(ii) $(-4y)^3 = -64y^3$

(iii) $32xy^2 \div 16x^2y = \frac{2y}{x}$

(iv) $\frac{5xy^2}{4y^3z} \times \frac{z^2}{4x^3} \div \frac{10xz}{16y^2}$
 $= \frac{5xy^2}{4y^3z} \times \frac{z^2}{4x^3} \times \frac{16y^2}{10xz}$
 $= \frac{x^2y^3}{2x^4y^3}$
 $= \frac{1}{2x^2}$

③

$$\begin{aligned} a) \quad x - 4y + 7 - (2x + y - 10) \\ = x - 4y + 7 - 2x - y + 10 \\ = -x - 5y + 17 \end{aligned}$$

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

$$\begin{aligned} (ii) \quad 3(2y - 4) - 5(7 - 2y) \\ = 6y - 12 - 35 + 10y \\ = 16y - 47 \end{aligned}$$

$$\begin{aligned} (iii) \quad (2a - 3)(2a + 3) \\ = 4a^2 - 9 \end{aligned}$$

$$\begin{aligned} (iv) \quad (x - 3)(2x^2 + 2x - 1) \\ = 2x^3 + 2x^2 - x - 6x^2 - 6x + 3 \\ = 2x^3 - 4x^2 - 7x + 3 \end{aligned}$$

$$(v) \quad (2a + 7)^2 = 4a^2 + 28a + 49$$

$$\begin{aligned} (vi) \quad (6a - b)(5a + 2b) \\ = 30a^2 + 12ab - 5ab - 2b^2 \\ = 30a^2 + 7ab - 2b^2 \end{aligned}$$

④

$$\begin{aligned} (i) \quad 4a + 2ax - 4b - 2bx \\ = 2a(2 + x) - 2b(2 + x) \\ = (2 + x)(2a - 2b) \\ = 2(2 + x)(a - b) \end{aligned}$$

$$\begin{aligned} (ii) \quad 27 - x^3 \\ = (3 - x)(9 + 3x + x^2) \end{aligned}$$

$$\begin{aligned} (iii) \quad x^2 + 10x + 25 \\ = (x + 5)^2 \end{aligned}$$

$$\begin{aligned} (iv) \quad 3x^2 - 17x + 20 \\ = (3x - 5)(x - 4) \end{aligned}$$

$$\begin{aligned} (v) \quad 2x^3 + 16 \\ = 2(x^3 + 8) \\ = 2(x + 2)(x^2 - 2x + 4) \end{aligned}$$

$$\begin{aligned} (vi) \quad y^3 - 3y^2 - 4y + 12 \\ = y^2(y - 3) - 4(y - 3) \\ = (y - 3)(y^2 - 4) \\ = (y - 3)(y - 2)(y + 2) \end{aligned}$$

(5)

$$(a) \frac{x^2 - x - 6}{x(x+2)} \div \frac{x^2 - 9}{9}$$

$$= \frac{\cancel{(x-3)}(x+2)}{x(x+2)} \times \frac{9}{\cancel{(x-3)}(x+3)}$$

$$= \frac{9}{x(x+3)}$$

$$(b) \frac{1}{a^2 - a} + \frac{1}{a^2 + a}$$

$$= \frac{1}{a(a-1)} + \frac{1}{a(a+1)}$$

$$= \frac{a+1 + a-1}{a(a-1)(a+1)}$$

$$= \frac{2a}{a(a-1)(a+1)}$$

$$= \frac{2}{(a-1)(a+1)}$$

$$(c) \frac{1 - x^{-1}}{x^{-2} - x^{-1}} = \frac{1 - \frac{1}{x}}{\frac{1}{x^2} - \frac{1}{x}}$$

$$= \frac{x-1}{x} \div \frac{1-x}{x^2}$$

$$= \frac{x-1}{x} \times \frac{x^2}{1-x}$$

$$= -x$$

$$(d) \sqrt{16x^2y^2(y^2 + 8y + 16)}$$

$$= 4xy(y+4)$$

$$= 4xy^2 + 16xy$$

$$(e) \frac{2}{2+\sqrt{2}} = \frac{2(2-\sqrt{2})}{4-2}$$

$$= \frac{4-2\sqrt{2}}{2}$$

$$\frac{4}{2\sqrt{2}} = \frac{4\sqrt{2}}{4} = \sqrt{2}$$

$$\therefore \frac{2}{2+\sqrt{2}} + \frac{4}{2\sqrt{2}} = \frac{4-2\sqrt{2}}{2} + \sqrt{2}$$

$$= \frac{4-2\sqrt{2}+2\sqrt{2}}{2}$$

= 2, a rat. no.

$$(f) (i) \left(a + \frac{1}{a}\right)^2 = a^2 + 2 + \frac{1}{a^2}$$

$$(ii) \text{ If } \left(a + \frac{1}{a}\right) = 5$$

$$5^2 = a^2 + 2 + \frac{1}{a^2}$$

$$\therefore a^2 + \frac{1}{a^2} = 25 - 2$$

$$= 23$$

(g) (i)

$$9 + 6x - x^2$$

$$= -(x^2 - 6x - 9)$$

$$= -[x^2 - 6x + 9 - 9 - 9]$$

$$= -(x-3)^2 + 18$$

(ii) max value of $9 + 6x - x^2$ is 18, since $(x-3)^2 \geq 0$