



Mathematics

Question 1: (8 Marks) – Start A New Page

Marks

- | | |
|--|---|
| a) Is $\sqrt{2\frac{1}{4}}$ rational or irrational? Give a reason. | 1 |
| b) Simplify $\sqrt{28}$ | 1 |
| c) Find y if $\sqrt{y} = \sqrt{32} - \sqrt{2}$ | 2 |
| d) Expand and simplify | |
| (i) $(\sqrt{7} + 2)^2$ | 2 |
| (ii) $(2 - \sqrt{3})(2 + \sqrt{3})$ | 2 |

Question 2: (8 Marks) – Start A New Page

Marks

- | | |
|---|---|
| a) Simplify $2\sqrt{45} - 3\sqrt{12} + \sqrt{75}$ | 2 |
| b) Rationalise the denominator, expressing your answer in simplest form | |
| (i) $\frac{\sqrt{3}}{\sqrt{6}}$ | 2 |
| (ii) $\frac{2+\sqrt{3}}{3-\sqrt{3}}$ | 2 |
| c) Simplify $\frac{4}{\sqrt{5}-2} + \frac{2}{\sqrt{5}+2}$ | 2 |

Instructions

1. Reading time – 5 minutes
2. Working time – 70 minutes
3. All questions should be attempted.
4. Show all working.
5. **Start each question on a new page.**
6. Marks will be deducted for careless work or poorly presented solutions.
7. On the cover sheet of the answer booklet clearly show:
 - a) your name
 - b) your mathematics class and teacher

Question 3: (8 Marks) – Start A New Page

Marks

- a) Evaluate correct to 2 decimal places $\frac{2.4^3 + 3.1^2}{1.8^4}$ 1
- b) Write correct to 3 significant figures
- (i) 0.071042 1
- (ii) $\frac{\sqrt{2.9 \times \pi + 7}}{\sqrt[3]{5.8 \times 2.1 - 6}}$ 1
- c) If $p = 2.4 \times 10^4$, $q = 3.6 \times 10^6$ and $r = 7.2 \times 10^8$ evaluate $\frac{3pr}{2q}$ 2
(Answer in scientific notation)
- d) If the mass of 1 atom of oxygen is 2.7×10^{-23} grams, what is the mass of 8×10^{29} atoms of oxygen? Give your answer in scientific notation. 2
- e) After 10% G.S.T. is added, a car sells for \$26 400. What was the original price of the car. 1

Question 4: (8 Marks) – Start A New Page

Marks

- a) Simplify
- (i) $\frac{4x^3}{15y} \times \frac{(3y)^2}{2x^5}$ 2
- (ii) $(4p - 3q)^2 - (4p + 3q)^2$ 2
- (iii) $\frac{6x^2 + 12x}{3xy + 6y}$ 2
- b) Express $0.7\dot{5}$ as a fraction in simplest form. 2

Question 5: (8 Marks) – Start A New Page

Marks

Solve

- a) $\frac{x+1}{2} = \frac{x-3}{4}$ 2
- b) $x^2 = 6x$ 2
- c) $6x^2 - x - 1 = 0$ 2
- d) $2 - \frac{x-1}{5} = x$ 2

Question 6: (8 Marks) – Start A New Page

Marks

Factorise:

a) $x(x + 2) + 3(x + 2)$

1

b) $25y^2 - 16$

1

c) $12x^2 - 36x + 27$

2

d) $x^3 - 8$

2

e) $(2x - 7)^2 - (7 - 2x)$

2

Question 7: (8 Marks) – Start A New Page

Marks

a) Simplify:

(i) $\frac{x+1}{x+2} + \frac{x-1}{x^2+7x+10}$

3

(ii) $\frac{p^2+6p-27}{10p+10} \div \frac{p-3}{5}$

2

b) Solve simultaneously $x - y = 1$

3

$$y = x^2 - 3$$

Question 8: (8 Marks) – Start A New Page

Marks

a) Factorise fully $8x^5 - 72x^3 + x^2 - 9$

3

b) Simplify $\frac{1}{1+\sqrt{1+a}} + \frac{1}{1-\sqrt{1+a}}$

2

c) If $x = 2\sqrt{3} + 1$ express $\frac{1}{x-1} + \frac{1}{x+1} - \frac{2}{x^2-1}$ as a single fraction in simplest form with a rational denominator.

3

Year 11 Common Test-1

Qn1. a) $\sqrt{\frac{9}{7}} = \frac{3}{\sqrt{7}}$ which is rational as can be written in form $\frac{a}{b}$ where $b \neq 0$

$$b) \sqrt{28} = \sqrt{4 \times 7} \\ = 2\sqrt{7}$$

$$c) \text{ RHS } \sqrt{32} - \sqrt{2} \\ = \sqrt{16 \times 2} - \sqrt{2} \\ = 4\sqrt{2} - \sqrt{2} \\ = 3\sqrt{2}$$

As an entire surd $3\sqrt{2}$
 $= \sqrt{9 \times 2}$
 $= \sqrt{18}$

Now $\sqrt{y} = \sqrt{18}$
 $\therefore y = 18$

$$d) \text{ (i) } (\sqrt{7}+2)^2 = (\sqrt{7})^2 + 2 \times 2 \times \sqrt{7} + 2^2 \\ = 7 + 4\sqrt{7} + 4 \\ = 11 + 4\sqrt{7}$$

$$\text{(ii) } (2-\sqrt{3})(2+\sqrt{3}) = (2)^2 - (\sqrt{3})^2 \\ = 4 - 3 \\ = 1$$

$$\text{Qn2. a) } 2\sqrt{45} - 3\sqrt{12} + \sqrt{75}$$

$$= 2\sqrt{9 \times 5} - 3\sqrt{4 \times 3} + \sqrt{25 \times 3} \\ = 6\sqrt{5} - 6\sqrt{3} + 5\sqrt{3} \\ = 6\sqrt{5} - \sqrt{3}$$

$$b) \text{ (i) } \frac{\sqrt{3}}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}}$$

$$= \frac{\sqrt{18}}{6} \\ = \frac{\sqrt{9 \times 2}}{6} \\ = \frac{3\sqrt{2}}{6} \\ = \frac{\sqrt{2}}{2}$$

$$\text{2 (ii) } \frac{2+\sqrt{3}}{3-\sqrt{3}} \times \frac{3+\sqrt{3}}{3+\sqrt{3}}$$

$$= \frac{(2+\sqrt{3})(3+\sqrt{3})}{(3)^2 - (\sqrt{3})^2} \\ = \frac{6 + 2\sqrt{3} + 3\sqrt{3} + 3}{9 - 3} \\ = \frac{9 + 5\sqrt{3}}{6}$$

$$c) \frac{4}{\sqrt{5}-2} \times \frac{\sqrt{5}+2}{\sqrt{5}+2} + \frac{2}{\sqrt{5}+2} \times \frac{\sqrt{5}-2}{\sqrt{5}-2}$$

$$= \frac{4\sqrt{5}+8}{(\sqrt{5})^2-2^2} + \frac{2\sqrt{5}-4}{(\sqrt{5})^2-2^2}$$

$$= \frac{6\sqrt{5}+4}{1} \\ = 6\sqrt{5}+4$$

Qn 3.

(a) 2.23

(b) (i) 0.0710

(ii) 2.19

$$(c) \frac{3 \times 2.4 \times 10^4 \times 7.2 \times 10^8}{2 \times 3.6 \times 10^6}$$

$$= \frac{5.184 \times 10^{13}}{7.2 \times 10^6}$$

$$= 0.72 \times 10^7$$

$$= 7.2 \times 10^6$$

$$= 7200000$$

d) $2.7 \times 10^{-23} \times 8 \times 10^{29}$

$$= 21.6 \times 10^6$$

$$= 2.16 \times 10^7$$

e) 110% of original Price = \$26400

$$1\% \text{ " } = \frac{26400}{110}$$

$$\therefore 100\% \text{ " } = \frac{26400}{110} \times 100 \therefore \underline{\underline{\$24000}}$$

Qn 4.

a) (i) $\frac{4x^3}{15y} \times \frac{(3y)^2}{2x^5}$

ETA

$$= \frac{\cancel{4}^2 x^3}{15y} \times \frac{9y^2}{\cancel{2}^1 x^5}$$

$$= \frac{2}{15y} \times \frac{9y^2}{x^2}$$

$$= \frac{2 \times 3y}{5 x^2}$$

$$= \frac{6y}{5x^2}$$

(ii) $(4p-3q)^2 - (4p+3q)^2$

$$= 16p^2 - 24pq + 9q^2 - (16p^2 + 24pq + 9q^2)$$

$$= 16p^2 - 24pq + 9q^2 - 16p^2 - 24pq - 9q^2$$

$$= \underline{\underline{-48pq}}$$

$$(iii) \frac{6x^2 + 12x}{3xy + 6y}$$

$$= \frac{2 \cancel{6} x (x+2)}{3y (x+2)}$$

$$= \frac{2x}{y}$$

$$b) \text{ Let } x = 0.75555 \dots$$

$$10x = 7.5555 \dots \quad (1)$$

$$100x = 75.5555 \dots \quad (2)$$

(2) - (1)

$$90x = 68$$

$$x = \frac{68}{90}$$

$$\therefore x = \frac{34}{45}$$

Qn 5.

$$a) (i) \frac{x+1}{2} = \frac{x-3}{4}$$

$$4(x+1) = 2(x-3)$$

$$4x+4 = 2x-6$$

$$2x = -10$$

$$\therefore x = -5$$

$$(ii) x^2 - 6x = 0$$

$$x(x-6) = 0$$

$$\therefore x = 0 \text{ or } x = 6$$

$$(iii) 6x^2 - x - 1 = 0 \quad 6 \times 1 = -6$$

$$6x^2 - 3x + 2x - 1 = 0 \quad -3, 2$$

$$3x(2x-1) + (2x-1) = 0$$

$$(3x+1)(2x-1) = 0$$

$$3x+1 = 0 \text{ or } 2x-1 = 0$$

$$3x = -1$$

$$2x = 1$$

$$x = -\frac{1}{3}$$

$$x = \frac{1}{2}$$

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

$$(x \text{ by } 5) 10 - (x-1) = 5x$$

$$10 - x + 1 = 5x$$

$$11 = 6x$$

$$x = \frac{11}{6} \text{ or } \frac{15}{7}$$

Qn 6.

$$a) (x+3)(x+2)$$

$$b) (5y)^2 - 4^2 \\ = (5y-4)(5y+4)$$

$$c) 12x^2 - 36x + 27 \\ = 3(4x^2 - 12x + 9) \\ = 3(2x-3)^2$$

$$d) (x^3 - 8) \\ = x^3 - 2^3 \\ = (x-2)(x^2 + 2x + 4)$$

$$e) (2x-7)^2 - (7-2x) \\ = (2x-7)^2 + (2x-7) \\ = (2x-7)[(2x-7)+1] \\ = (2x-7)(2x-6) \\ = 2(2x-7)(x-3)$$

Qn 7.

$$a) \text{ (i) } \frac{x+1}{x+2} + \frac{x-1}{x^2+7x+10} \\ = \frac{x+1}{x+2} + \frac{x-1}{(x+2)(x+5)} \\ = \frac{(x+1)(x+5)}{(x+2)(x+5)} + \frac{(x-1)}{(x+2)(x+5)} \\ = \frac{\cancel{x}^2 + 5x + x + 5 + x - 1}{(x+2)(x+5)} \\ = \frac{x^2 + 7x + 4}{(x+2)(x+5)}$$

$$\text{ (ii) } \frac{p^2+6p-27}{10p+10} \times \frac{5}{p-3} \\ = \frac{(p-3)(p+9)}{2(p+1)} \times \frac{\cancel{5}}{p-3} \\ = \frac{p+9}{2(p+1)}$$

$$b) \quad x - y = 1 \quad (1)$$

$$y = x^2 - 3 \quad (2)$$

Rearranging (1) we get $y = x - 1 \quad (3)$

Substituting (3) into (2)

$$y = x^2 - 3 \text{ becomes}$$

$$(x-1) = x^2 - 3$$

$$0 = x^2 - x - 2$$

$$x^2 - x - 2 = 0$$

$$(x-2)(x+1) = 0$$

$$\therefore \underline{x=2} \text{ OR } \underline{x=-1}$$

When $x=2, y=1$

$x=-1, y=-1-1$
 $y=-2$

Qn8.

$$a) \quad 8x^5 - 72x^3 + x^2 - 9$$

$$= 8x^3(x^2 - 9) + (x^2 - 9)$$

$$= (8x^3 + 1)(x^2 - 9)$$

$$= \underline{(2x+1)(4x^2-2x+1)(x+3)(x-3)}$$

$$b) \quad \frac{1}{(1+\sqrt{1+a})} \times \frac{(1-\sqrt{1+a})}{(1-\sqrt{1+a})} + \frac{1}{1-\sqrt{1+a}} \times \frac{1+\sqrt{1+a}}{1+\sqrt{1+a}}$$

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

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

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

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

$$= \frac{2}{-a} = -\frac{2}{a}$$

$$c) \quad \frac{1}{x-1} + \frac{1}{x+1} - \frac{2}{x^2-1}$$

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

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

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

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

$$= \frac{2}{x+1}$$

Now $x = 2\sqrt{3} + 1$, substituting we obtain

$$\frac{2}{2\sqrt{3} + 1 + 1}$$

$$= \frac{2}{2\sqrt{3} + 2}$$

$$= \frac{2}{2(\sqrt{3} + 1)} = \frac{1}{\sqrt{3} + 1} \times \frac{\sqrt{3} - 1}{\sqrt{3} - 1} = \frac{\sqrt{3} - 1}{2}$$