

(46 marks)

Write the answer to each question on *the question paper*. Show all working.

Question 1**(11 marks)**

a) Find the value of $13^{-1.3}$ correct to three decimal places.

(1)

b) Convert the recurring decimal, $1.\dot{2}\dot{3}$ to a fraction (rational number).
(show all working – as if not using a calculator)

(2)

c) Express without using negative or fractional powers:

(3)

i) x^{-3}

ii) $(y + 4)^{-\frac{2}{3}}$

d) Using your calculator, evaluate, correct to 2 decimal places:

$$\frac{72.094 \times 116.8}{79.64^2 - 16.78^2}$$

(2)

e) The speed of light is 299 725 km/sec. Write this number correct to the nearest hundred.

(1)

f) The distance from the sun to the earth is 149 492 000 km. Write this in scientific notation, correct to three significant figures.

(2)

Question 2**(12 marks)**

a) Simplify:

i)
$$\frac{a-6b}{2a-12b}$$

(1)

ii)
$$\frac{x^2+4x-5}{x^2-25}$$

(2)

b) Factorize:

i)
$$2x^2 + 3x - 2$$

(2)

ii)
$$8a^3 - 27$$

(2)

c) Simplify:

i) $\frac{2}{a} + \frac{5}{a+b}$

(2)

ii) $\frac{2a-3b}{5} \div \frac{4a^2-9b^2}{15}$

(3)

Question 3**(5 marks)**

a) Evaluate:

i) $4|-3| \div |-2|$

(1)

ii) $3 - |-2| + 5|4 \times -3|$

(1)

iii) $|ab|$ when $a = -5$ and $b = 6$

(1)

b) Solve:

$|x - 2| = 3$

(2)

Question 4**(9 marks)**

Simplify:

a) $\sqrt{63}$

(2)

b) $4\sqrt{96} + 3\sqrt{6} - 5\sqrt{54}$

(3)

c) If $a = \frac{\sqrt{3-1}}{\sqrt{2}}$ and $b = \frac{\sqrt{3+1}}{\sqrt{2}}$ then find: (*rationalize denominators if needed*)

i. **ab**

(2)

ii. $a - b$

(2)

Question 5**(9 marks)**

a) Solve:

i)
$$\frac{x-3}{3} - \frac{x+5}{2} = 4$$

(3)

ii) $2a - 6 \leq 5a - 3.$

Show your answer on a number line.

(3)

b) Mark on a number line the values of x for which $|3x - 2| \leq 4.$

(3)

(4 marks)

Write the answer to each question on *the question paper*. Show all working.

Question 1

(11 marks)

- a) Find the value of
- $13^{-1.3}$
- correct to three decimal places.

$$0.036 \checkmark$$

(1)

- b) Convert the recurring decimal,
- $1.\dot{2}\dot{3}$
- to a fraction (rational number).
-
- (show all working – as if
- not
- using a calculator)

(2)

$$\text{Let } x = 1.2323\dots$$

$$100x = 123.2323\dots \checkmark$$

$$- x = 1.2323\dots$$

$$\hline 99x = 122.0000$$

$$x = \frac{122}{99} \checkmark$$

- c) Express without using
- negative
- or
- fractional
- powers:

(3)

i) x^{-3}

$$= \frac{1}{x^3} \checkmark$$

ii) $(y+4)^{-\frac{2}{3}}$

$$= \frac{1}{(y+4)^{\frac{2}{3}}} \checkmark$$

$$= \frac{1}{\sqrt[3]{(y+4)^2}} \checkmark$$

d) Using your calculator, evaluate, correct to 2 decimal places:

$$\frac{(72.094 \times 116.8)}{(79.64^2 - 16.78^2)}$$

$$= 1.38931$$

$$\approx 1.39$$

(2)

e) The speed of light is 299 725 km/sec. Write this number correct to the nearest hundred.

$$299\,700 \text{ km/sec}$$

(1)

f) The distance from the sun to the earth is 149 492 000 km. Write this in scientific notation, correct to three significant figures.

$$1.49\,492\,000 \times 10^8$$

$$\therefore 1.49 \times 10^8 \quad (3 \text{ s.f.})$$

(2)

Question 2

(12 marks)

a) Simplify:

$$\begin{aligned} \text{i) } \frac{a-6b}{2a-12b} &= \frac{(a-6b)}{2(a-6b)} \\ &= \frac{1}{2} \end{aligned} \quad (1)$$

$$\begin{aligned} \text{ii) } \frac{x^2+4x-5}{x^2-25} &= \frac{(x-1)(x+5)}{(x-5)(x+5)} \\ &= \frac{x-1}{x-5} \end{aligned} \quad (2)$$

b) Factorize:

$$\begin{aligned} \text{i) } 2x^2 + 3x - 2 &= 2x^2 + 4x - x - 2 \\ &= 2x(x+2) - (x+2) \\ &= (x+2)(2x-1) \end{aligned} \quad (2)$$

$$\begin{aligned} \text{ii) } 8a^3 - 27 &= (2a)^3 - 3^3 \\ &= (2a-3)(4a^2+6a+9) \end{aligned} \quad (2)$$

c) Simplify:

$$\begin{aligned}
 \text{i)} \quad \frac{2}{a} + \frac{5}{a+b} &= \frac{2(a+b) + 5a}{a(a+b)} \checkmark \\
 &= \frac{2a + 2b + 5a}{a(a+b)} \checkmark \\
 &= \frac{7a + 2b}{a(a+b)} \checkmark
 \end{aligned}
 \tag{2}$$

$$\begin{aligned}
 \text{ii)} \quad \frac{2a-3b}{5} \div \frac{4a^2-9b^2}{15} &= \frac{2a-3b}{5} \div \frac{(2a-3b)(2a+3b)}{15} \checkmark \\
 &= \frac{\cancel{(2a-3b)}}{5} \times \frac{3 \cancel{15}}{\cancel{(2a-3b)}(2a+3b)} \checkmark \\
 &= \frac{3}{(2a+3b)} \checkmark
 \end{aligned}
 \tag{3}$$

Question 3

(5 marks)

a) Evaluate:

i) $4|-3| + |-2|$

$$= 4 \times 3 + 2$$

$$= 12 + 2$$

$$= 14 \quad \checkmark$$

(1)

ii) $3 - |-2| + 5|4 \times -3|$

$$= 3 - 2 + 5(12)$$

$$= 1 + 60 \quad \checkmark$$

$$= 61$$

(1)

iii) $|ab|$ when $a = -5$ and $b = 6$

$$|-5 \times 6| = 30 \quad \checkmark$$

(1)

b) Solve:

$$|x - 2| = 3$$

(2)

$$x - 2 = 3$$

or

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

$$x = 5 \quad \checkmark$$

$$-x + 2 = 3$$

$$-x = 1$$

$$x = -1 \quad \checkmark$$

Question 4

(9 marks)

Simplify:

a) $\sqrt{63}$

$$= \sqrt{9 \times 7}$$

$$= 3\sqrt{7}$$

(2)

b) $4\sqrt{96} + 3\sqrt{6} - 5\sqrt{54}$

$$= 4\sqrt{16 \times 6} + 3\sqrt{6} - 5\sqrt{6 \times 9}$$

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

$$= 16\sqrt{6} + 3\sqrt{6} - 15\sqrt{6}$$

$$= 4\sqrt{6}$$

(3)

c) If $a = \frac{\sqrt{3-1}}{\sqrt{2}}$ and $b = \frac{\sqrt{3+1}}{\sqrt{2}}$ then find: (rationalize denominators if needed)

i. ab

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

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

(2)

ii. $a-b$

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

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

$$= 1 - 2\sqrt{2}$$

(2)

Question 5

(9 marks)

a) Solve:

$$i) \frac{x-3}{3} - \frac{x+5}{2} = 4 \quad (3)$$

$$2(x-3) - 3(x+5) = 4 \times 6 \quad \checkmark$$

$$2x - 6 - 3x - 15 = 24$$

$$-x - 21 = 24 \quad \checkmark$$

$$-x = 45$$

$$x = -45 \quad \checkmark$$

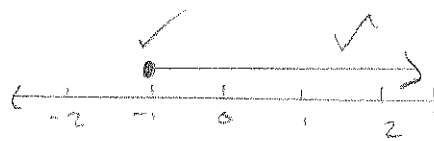
$$ii) 2a - 6 \leq 5a - 3.$$

Show your answer on a number line.

$$-3 \leq 3a \quad \checkmark$$

$$-1 \leq a \quad \checkmark$$

$$\therefore a \geq -1$$



(3)

b) Mark on a number line the values of x for which $|3x - 2| \leq 4$.

$$3x - 2 \leq 4$$

$$3x \leq 6$$

$$x \leq 2$$

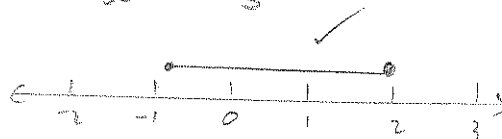
$$\text{or } -(3x - 2) \leq 4$$

$$-3x + 2 \leq 4$$

$$-3x \leq 2$$

$$x \geq -\frac{2}{3}$$

$$\therefore -\frac{2}{3} \leq x \leq 2 \quad \checkmark$$



(3)

