

# WORKED SOLUTIONS

## Mock Topics 9-20 Test

Name: \_\_\_\_\_

Q1.

$$\frac{4 \times 10^9 + 3.2 \times 10^7}{1.6 \times 10^{-6}}$$

Work out

$$1.6 \times 10^{-6}$$

Give your answer in standard form.

$$= \frac{4.032 \times 10^9}{1.6 \times 10^{-6}}$$

$$= 2.52 \times 10^{15}$$

(Total for Question is 2 marks)

Q2.

(a) Write 5 400 000 as a number in standard form.

$$5.4 \times 10^6$$

(1)

(b) Write  $3.2 \times 10^{-4}$  as an ordinary number.

$$0.00032$$

(1)

The mass of the Sun is  $2 \times 10^{30}$  kg.

The mass of the largest known star is 315 times the mass of the Sun.

(c) Work out the mass of this star.

Give your answer in kg in standard form.

$$= 315 \times 2 \times 10^{30}$$

$$= 630 \times 10^{30}$$

$$= 6.3 \times 10^{32}$$

$$6.3 \times 10^{32} \text{ kg}$$

(2)

(Total for question = 4 marks)

Q3.

Express the recurring decimal  $0.2\overline{81}$  as a fraction in its simplest form.

$$\begin{aligned}
 x &= 0.28181\dots \\
 10x &= 2.818181\dots \\
 1000x &= 281.818181 \\
 990x &= 279
 \end{aligned}
 \rightarrow x = \frac{279}{990} = \frac{31}{110}$$

(Total for Question is 3 marks)

Q4.

(a) Express  $5\sqrt{27}$  in the form  $n\sqrt{3}$ , where  $n$  is a positive integer.

$$\begin{aligned}
 &= 5 \times \sqrt{9} \times \sqrt{3} \\
 &= 15\sqrt{3}
 \end{aligned}$$

(2)

(b) Rationalise the denominator of  $\frac{21}{\sqrt{3}}$ 

$$\begin{aligned}
 &= \frac{21}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{21\sqrt{3}}{3} \\
 &= 7\sqrt{3}
 \end{aligned}$$

(2)

(Total for Question is 4 marks)

Q5.

Write  $(5 - \sqrt{5})^2$  in the form  $a + b\sqrt{5}$ , where  $a$  and  $b$  are integers.

$$\begin{aligned}
 &= (5 - \sqrt{5})(5 - \sqrt{5}) = 25 - 5\sqrt{5} - 5\sqrt{5} + 5 \\
 &= 30 - 10\sqrt{5}
 \end{aligned}$$

$$30 - 10\sqrt{5}$$

(Total for Question is 2 marks)

Q6.

Rationalise the denominator of  $\frac{10}{\sqrt{5}}$   
Give your answer in its simplest form.

$$\cancel{20} = \frac{10}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{10\sqrt{5}}{5} = 2\sqrt{5}$$

$$2\sqrt{5}$$

(Total for question = 2 marks)

Q7.

(a) Solve  $3x^2 = 147$

$$x^2 = 49$$

$$x = \pm\sqrt{49}$$

$$x = \pm 7$$

(2)

(b) Solve  $\frac{y-1}{2} + \frac{y+1}{3} = 15$

$$\frac{3(y-1)}{6} + \frac{2(y+1)}{6} = 15$$

$$\frac{3y-3+2y+2}{6} = 15$$

$$\frac{5y-1}{6} = 15$$

$$5y-1 = 90$$

$$5y = 91$$

$$y = 18.2$$

$$y = 18.2$$

(3)

(Total for question = 5 marks)

Q8.

(a) Solve  $4(y + 3) = 19$

$$4y + 12 = 19$$

$$4y = 7$$

$$y = \frac{7}{4} \text{ or } 1\frac{3}{4} \text{ or } 1.75$$

$$y = \dots 1.75 \dots$$

(2)

(b) Solve the inequality  $2p - 8 > 7$

$$2p > 15$$

$$p > 7.5$$

$$\dots p > 7.5 \dots$$

(2)

(c) Solve  $x^2 + 2x - 15 = 0$

$$(x - 3)(x + 5) = 0$$

$$x = 3 \text{ or } x = -5$$

$$\dots x = 3 \text{ or } -5 \dots$$

(3)

(Total for question = 7 marks)

Q9.

$$-2 \leq n < 3$$

$n$  is an integer. *← whole number*

(a) Write down all the possible values of  $n$ .

*-2, -1, 0, 1, 2, 3*

(2)

(b) Solve  $4 - x < 2x - 5$

$$4 < 3x - 5$$

$$9 < 3x$$

$$3 < x$$

*$x > 3$*

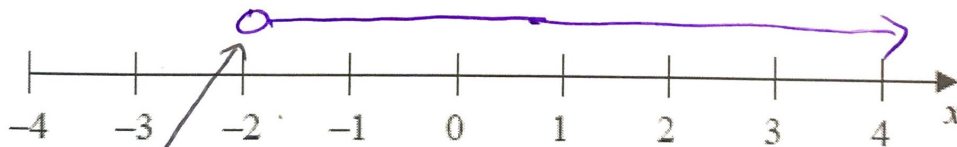
(2)

(Total for question = 4 marks)

Q10.

(a)  $x > -2$

Show this inequality on the number line.



*Don't shade as it can't equal -2*

(2)

(b) Work out the greatest integer that satisfies the inequality

$$4y - 1 < y + 7$$

$$3y - 1 < 7$$

$$3y < 8$$

$$y < \frac{8}{3}$$

*2*

(3)

Q11.

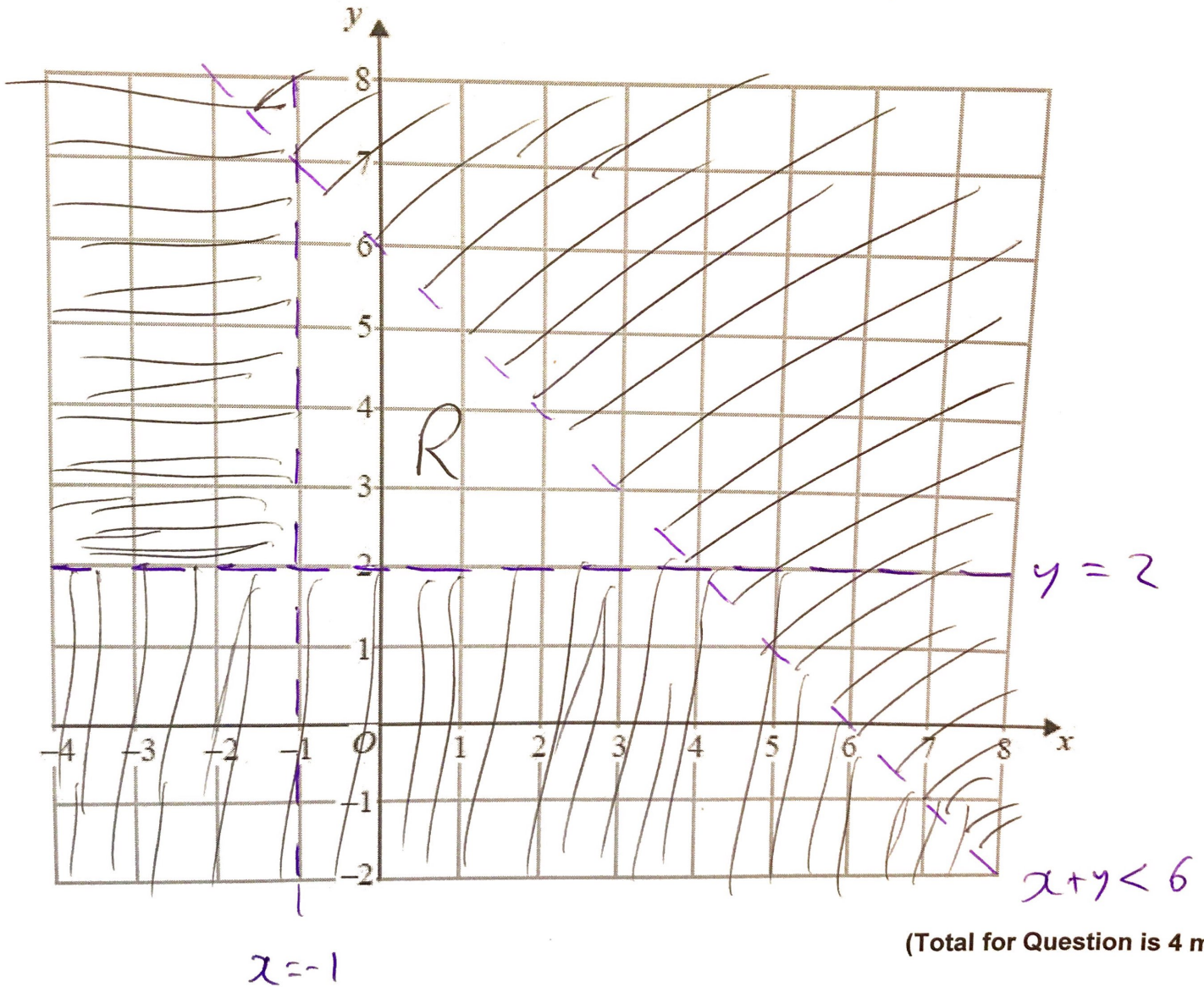
On the grid below, show by shading, the region defined by the inequalities

$$x + y < 6$$

$$x > -1$$

$$y > 2$$

Mark this region with the letter R.

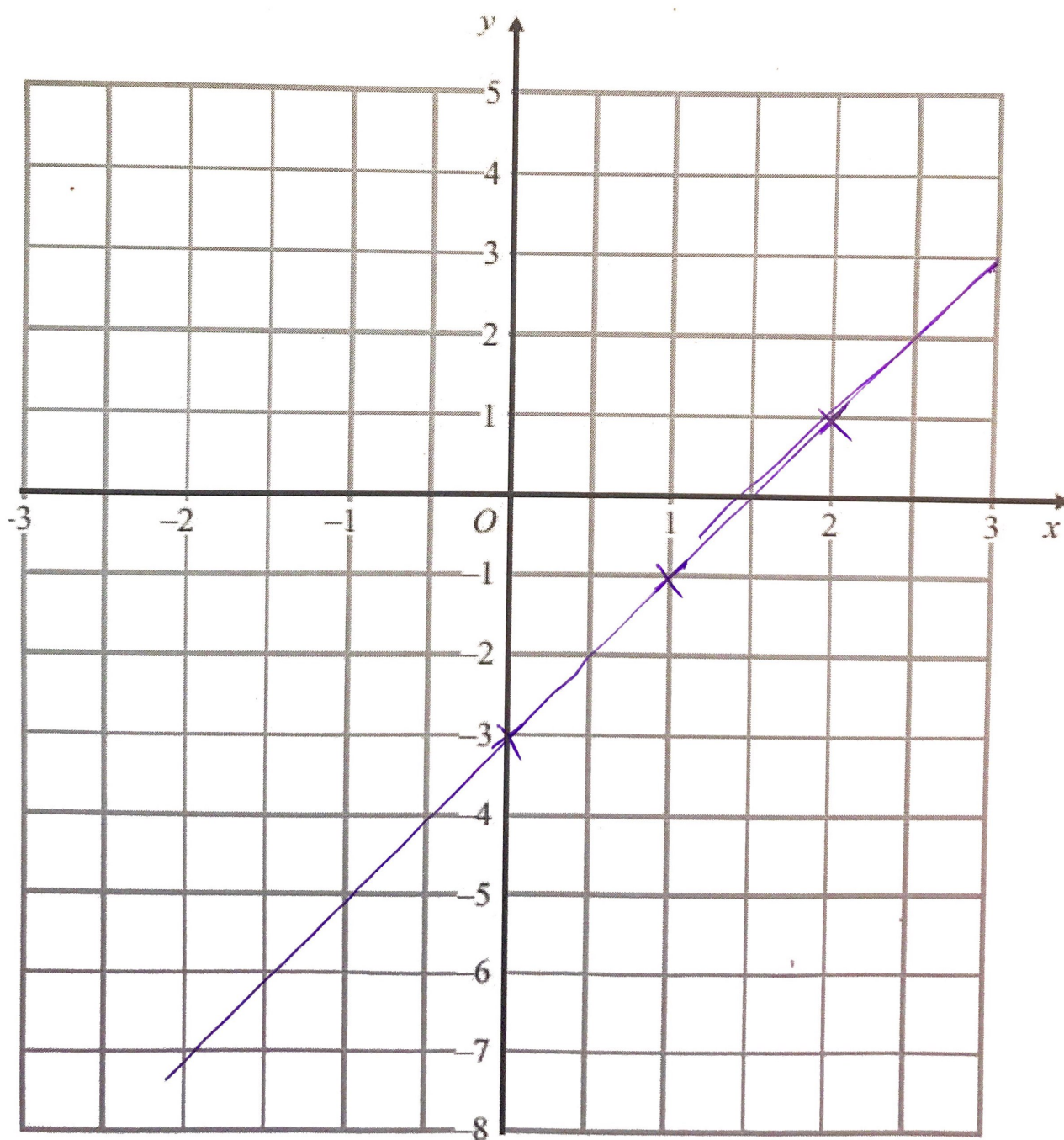


(Total for Question is 4 marks)

Q12.

On the grid, draw the graph of  $y = 2x - 3$  for values of  $x$  from  $-2$  to  $2$

$x$	0	1	2	<del>3</del>
$y$	-3	-1	1	<del>3</del>

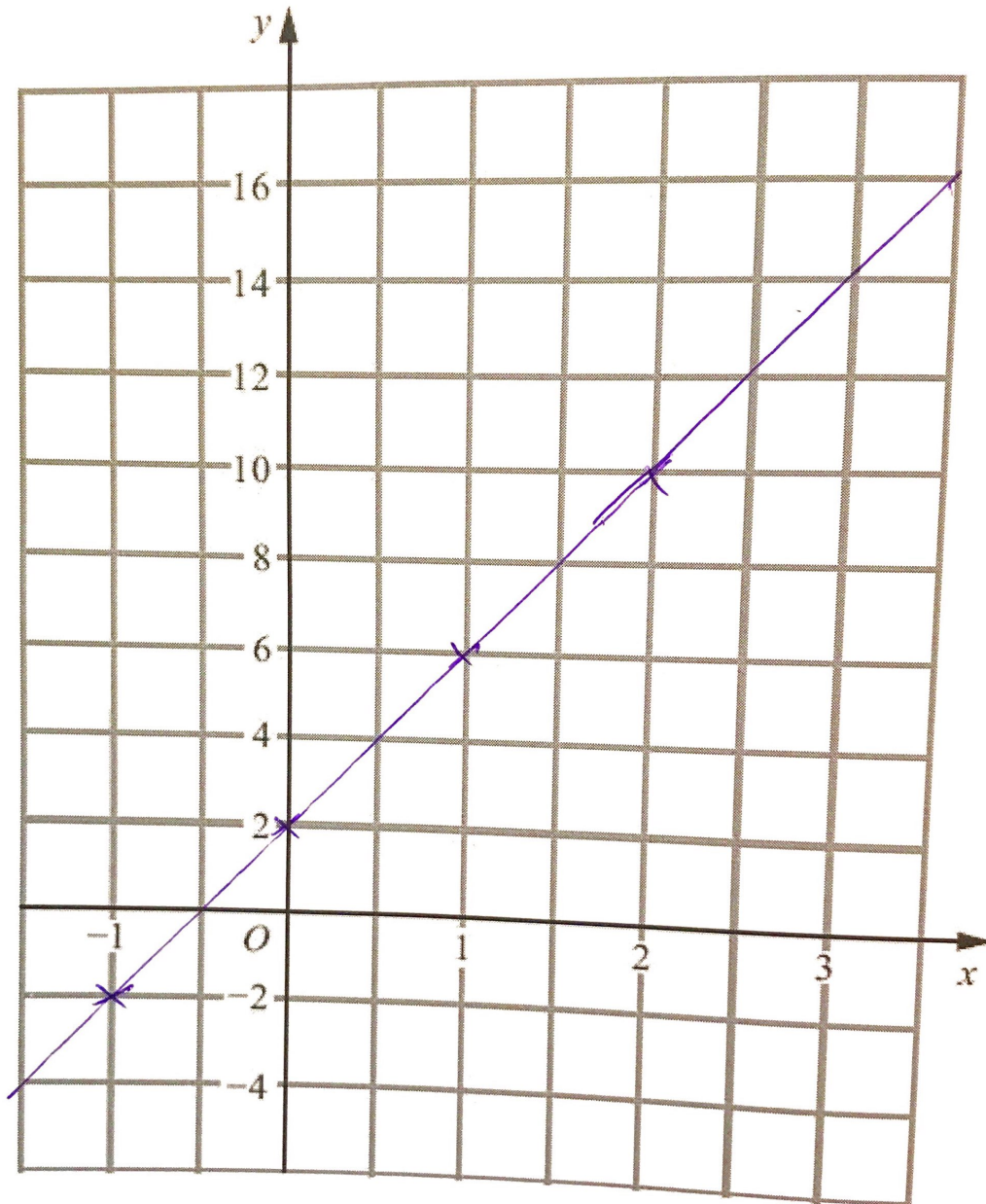


(Total for Question is 3 marks)

Q13.

(a) On the grid, draw the graph of  $y = 4x + 2$  from  $x = -1$  to  $x = 3$

$x$	0	1	2
$y$	2	6	10



(b) (i) Write down the equation of a straight line that is parallel to  $y = 4x + 2$

(3)

$y = 4x + \text{anything}$

(ii) Write down the gradient of a straight line that is perpendicular to  $y = 4x + 2$

$-\frac{1}{4}$  ← Negative reciprocal

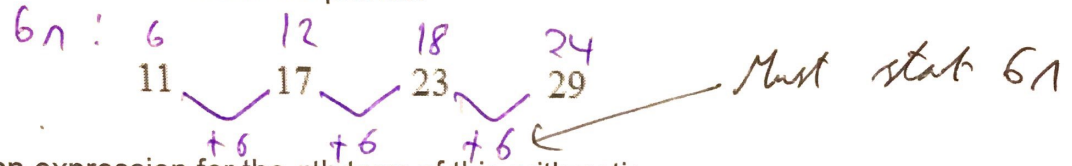
(2)

(Total for Question is 5 marks)



Q14.

Here are the first four terms of an arithmetic sequence.



(a) Find, in terms of  $n$ , an expression for the  $n$ th term of this arithmetic sequence.

$6n + 5$

(2)

(b) Is 121 a term of this arithmetic sequence? You must explain your answer.

$6n + 5 = 121, 6n = 116$   
 $6$  does not divide into  $116$   
 $\therefore 121$  not in sequence

(2)

(Total for question = 4 marks)

Q15.

Here are the first five terms of an arithmetic sequence.

- 1    5    9    13    17

(a) Write down an expression, in terms of  $n$ , for the  $n$ th term of this sequence.

$4n - 3$

(2)

The  $n$ th term of a different number sequence is  $3n^2 + 7$

(b) Find the 10th term of this sequence.

$3 \times 10^2 + 7$   
 $= 3 \times 100 + 7 = 307$

(2)

(Total for Question is 4 marks)

Q16.

Work out  $\frac{2}{5} + \frac{3}{8}$

Give your answer in its simplest form.

$$\frac{2}{5} + \frac{3}{8} = \frac{16}{40} + \frac{15}{40}$$

$$= \frac{31}{40}$$

(Total for Question is 2 marks)

Q17.

(a) Work out  $1\frac{1}{5} \times 2\frac{1}{3}$

Give your answer as a mixed number in its simplest form.

$$\frac{6}{5} \times \frac{7}{3} = \frac{42}{15} = 2\frac{12}{15}$$

$$2\frac{4}{5}$$

(3)

(b) Work out  $2\frac{7}{15} - 1\frac{2}{3}$

$$= \frac{37}{15} - \frac{5}{3}$$

$$= \frac{37}{15} - \frac{25}{15}$$

$$= \frac{12}{15} = \frac{4}{5}$$

$$\frac{4}{5}$$

(3)

(Total for question = 6 marks)

Simplify fully  $\frac{3x^2 - 6x}{x^2 + 2x - 8}$

$$= \frac{3x \cancel{(x-2)}}{\cancel{(x-2)}(x+4)}$$

$$\frac{3x}{x+4}$$

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(Total for Question is 3 marks)