

GCSE Mathematics

Practice Tests: Set 7

Paper 2H (Calculator)

Time: 1 hour 30 minutes

You should have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- **Calculators may be used.**
- Diagrams are NOT accurately drawn, unless otherwise indicated.
- You must **show all your working out.**



Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1. $M = 3x^2 - nx$

Substitution

Work out the value of M when $x = -2$ and $n = 5$

Substitute | $M = 3(-2)^2 - (5)(-2)$
 $= \underline{\underline{22}}$

$M = \dots\dots\dots 22$

(Total for Question 1 is 2 marks)

Sharing Ratio

2. Mortar mix is made by mixing cement, sand and quicklime in the ratio 1 : 2 : 3

(a) Work out the volume of sand needed to make 2.1 m^3 of mortar mix.

Proportion	Total parts = $1+2+3 = 6$									
($\div 6$)	$2.1 \text{ m}^3 = 6 \text{ parts}$									
C : S : Q	$0.35 \text{ m}^3 = 1 \text{ part}$									
($\times 0.35$)	<table style="margin-left: 20px;"> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;">↓</td> <td style="text-align: center;">↓</td> <td style="text-align: center;">↓</td> </tr> <tr> <td style="text-align: center;">0.35</td> <td style="text-align: center;"><u>0.7</u></td> <td style="text-align: center;">1.05</td> </tr> </table>	1	2	3	↓	↓	↓	0.35	<u>0.7</u>	1.05
1	2	3								
↓	↓	↓								
0.35	<u>0.7</u>	1.05								

..... 0.7 m^3
(2)

Julie has 0.75 m^3 of quicklime.
She has plenty of sand and cement.

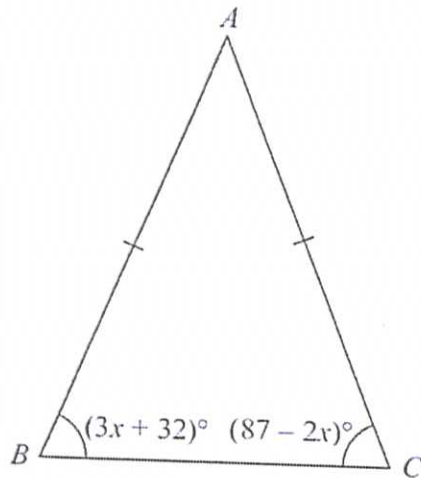
(b) Work out the greatest volume of mortar mix she could make.

C : S : Q	$0.75 \text{ m}^3 = 3 \text{ parts}$									
($\times 0.25$)	$0.25 \text{ m}^3 = 1 \text{ part}$									
Proportion	<table style="margin-left: 20px;"> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;">↓</td> <td style="text-align: center;">↓</td> <td style="text-align: center;">↓</td> </tr> <tr> <td style="text-align: center;">0.25</td> <td style="text-align: center;">0.50</td> <td style="text-align: center;">0.75</td> </tr> </table>	1	2	3	↓	↓	↓	0.25	0.50	0.75
1	2	3								
↓	↓	↓								
0.25	0.50	0.75								
	<p>Total = $0.25 + 0.50 + 0.75$ $= \underline{\underline{1.50 \text{ m}^3}}$</p>									

..... 1.5 m^3
(2)

(Total for Question 2 is 4 marks)

3.



Forming and Solving Linear Equations (angles)

Diagram NOT accurately drawn

In the isosceles triangle ABC ,
 $AB = AC$
angle $B = (3x + 32)^\circ$
angle $C = (87 - 2x)^\circ$

Work out the value of x .
You must show your working.

Base Isosceles
angles equal

$(+2x)$

(-32)

$(\div 5)$

$$3x + 32 = 87 - 2x$$

$$5x + 32 = 87$$

$$5x = 55$$

$$x = 11$$

$$x = \dots\dots\dots 11 \dots\dots\dots$$

(Total for Question 3 is 4 marks)

Calculator Skills

4. (a) Calculate the exact value of $\frac{(27.25)^2 - (12.75)^2}{0.75 - 0.25}$

$$\frac{1160}{\dots\dots\dots}$$

(1)

- (b) Write your answer to part (a) in standard form.

$$1160 = 1.16 \times 10^3$$

Standard Form

$$\frac{1.16 \times 10^3}{\dots\dots\dots}$$

(1)

- (c) Write your answer to part (a) to 2 significant figures.

$$11 \overset{\uparrow}{\underset{\cdot}{\underset{\cdot}{6}}} 0$$

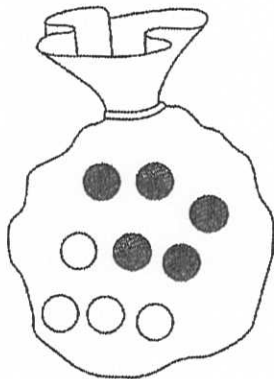
Rounding

$$\frac{1200}{\dots\dots\dots}$$

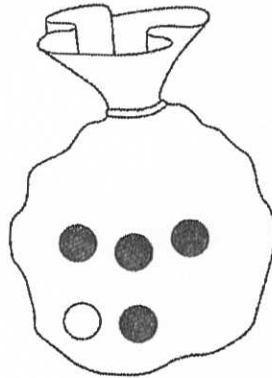
(1)

(Total for Question 4 is 3 marks)

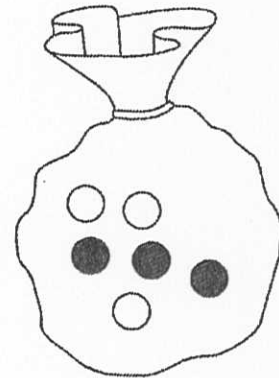
5.



Bag A



Bag B



Bag C

Three bags of counters are used in a game.

At the start of the game Bag A contains 5 red counters and 4 white counters.

Bag B contains 4 red counters and 1 white counter.

Bag C contains 3 red counters and 3 white counters.

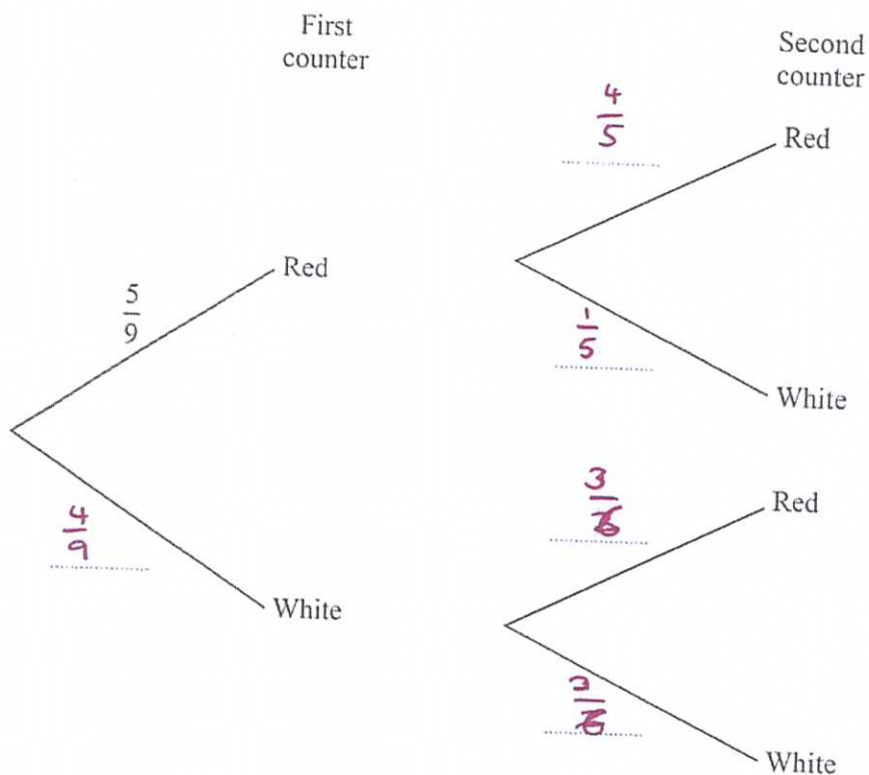
The game begins by taking at random a counter from Bag A.

If the counter is red, a counter is then taken at random from Bag B.

If the counter taken from Bag A is white, a counter is taken at random from Bag C.

Probability Trees

(a) Complete the probability tree diagram.



(b) Show that the probability that the second counter taken is red is twice the probability that the second counter taken is white. (3)

$$P(R, R) = \frac{5}{9} \times \frac{4}{5} = \frac{20}{45}$$

$$P(R, W) = \frac{5}{9} \times \frac{1}{5} = \frac{5}{45}$$

$$P(W, R) = \frac{4}{9} \times \frac{3}{8} = \frac{12}{54}$$

$$P(W, W) = \frac{4}{9} \times \frac{5}{8} = \frac{20}{54}$$

$$P(\text{second counter red}) = \frac{20}{45} + \frac{12}{54} = \frac{2}{3}$$

$$P(\text{second counter white}) = \frac{5}{45} + \frac{20}{54} = \frac{1}{3}$$

$$\frac{2}{3} = 2 \times \frac{1}{3} \quad \square$$

(5)

(Total for Question 5 is 8 marks)

Factorising Quadratics

6. (a) Factorise $x^2 - 16$

Difference of
two squares

$$(x+y)(x-y) = x^2 - y^2$$

$$(x+4)(x-4) = x^2 - 4^2$$

$$\frac{(x+4)(x-4)}{\dots\dots\dots}$$

(1)

(b) Factorise $9x^2 - 6x + 1$

$$(3x - 1)(3x - 1)$$

$$= \frac{(3x-1)^2}{\dots\dots\dots}$$

(2)

(c) Simplify $\frac{6x^2 + 7x - 3}{9x^2 - 6x + 1}$

factorise top

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

factorise bottom

$$(3x - 1)(3x - 1)$$

Simplify

$$\frac{\cancel{(3x-1)}(2x+3)}{\cancel{(3x-1)}(3x-1)} =$$

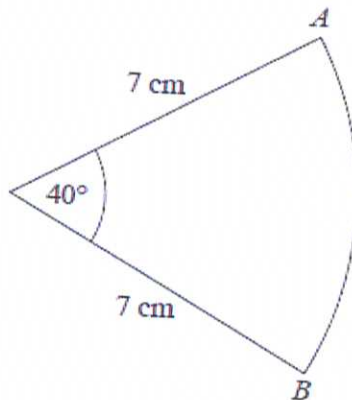
$$\frac{2x+3}{3x-1}$$

(3)

(Total for Question 6 is 6 marks)

Arc Length

7. The diagram shows a sector of a circle of radius 7 cm.



Work out the length of arc AB.

Give your answer correct to 3 significant figures.

$$\text{Arc length} = \frac{\theta}{360} \pi d$$

(d = 14)

$$\frac{40}{360} \times 7\pi$$

$$= 4.88 \text{ (3 s.f.)}$$

..... 4.88 cm

(Total for Question 7 is 2 marks)

8. The fraction, p , of an adult's dose of medicine which should be given to a child who weighs w kg is given by the formula

$$p = \frac{3w + 20}{200}$$

Solving Equations

Use the formula $p = \frac{3w + 20}{200}$ to find the weight of a child whose dose is the same as an adult's dose.

"Fraction" out of 1

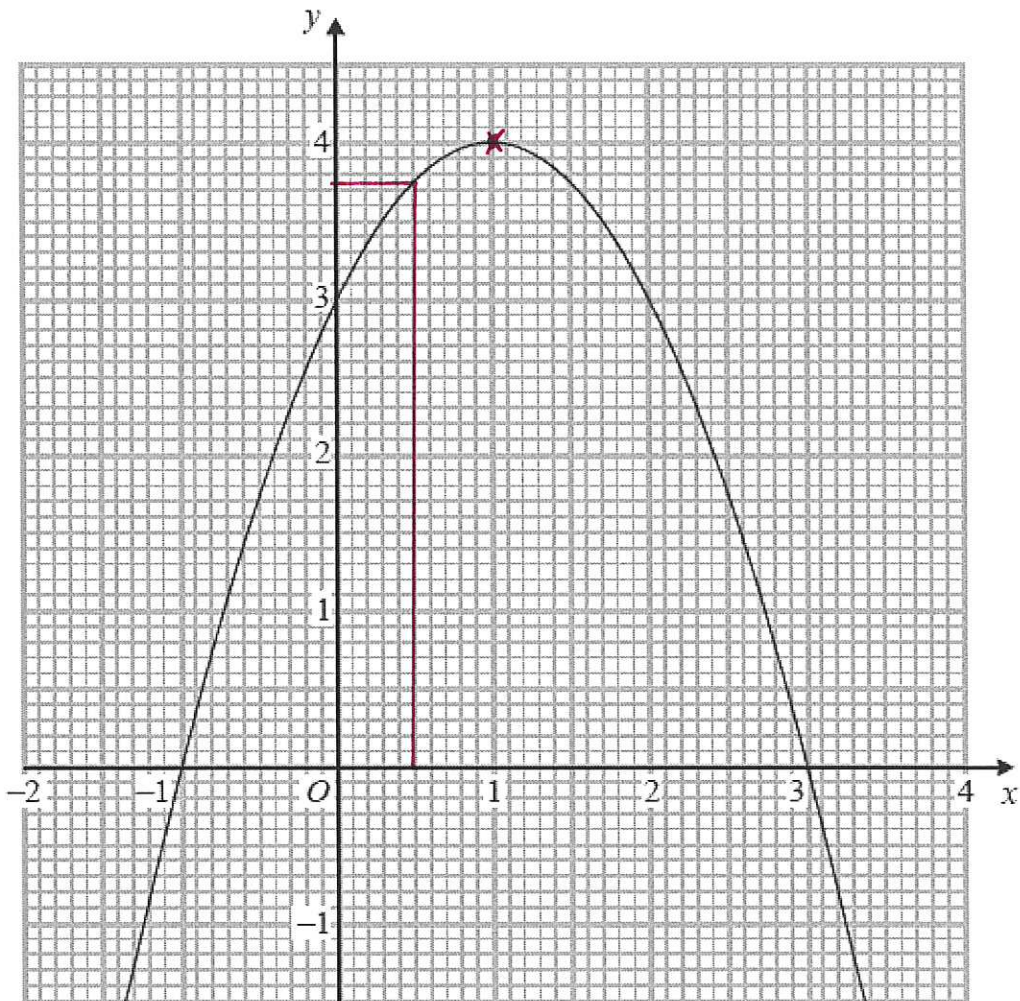
$$\begin{array}{l|l} \text{(x200)} & 1 = \frac{3w+20}{200} \\ \text{(-20)} & 200 = 3w+20 \\ \text{(:=3)} & 180 = 3w \\ & \underline{60 = w} \end{array}$$

..... kg

(Total for Question 8 is 3 marks)

Functions

9. The graph of $y = f(x)$ is drawn on the grid.



- (a) Write down the coordinates of the turning point of the graph.

(.....,)

(1)

- (b) Write down the roots of $f(x) = 0$

x-intercept

-1 and 3

(1)

- (c) Write down the value of $f(0.5)$

input = $x = 0.5$

3.75

(1)

(Total for Question 9 is 3 marks)

Probability of Independent Events

10. (a) $\frac{3}{10}$ of the members of a tennis club are men.
 $\frac{5}{6}$ of these men are right-handed.

Work out the fraction of the members of the tennis club who are right-handed men.

$$P(\text{man}) = \frac{3}{10}$$

$$P(\text{right}) = \frac{5}{6}$$

$$P(\text{man and right}) = \frac{3}{10} \times \frac{5}{6} = \frac{15}{60} = \frac{1}{4}$$

$$\frac{1}{4}$$

(2)

- (b) $\frac{7}{12}$ of the members of a badminton club are women.

$\frac{3}{8}$ of the members of the badminton club wear glasses.

Lowest Common Multiple

Work out the smallest possible number of members of the badminton club.

$$P(\text{women}) = \frac{7}{12}$$

$$P(\text{glasses}) = \frac{3}{8}$$

can there be 8 people? \times

12 ? \times

16 ? \times

24 ? \checkmark

8 : 8 16 24
12 : 12 24

24

(2)

(Total for Question 10 is 4 marks)

Solving Linear Equations

11. Solve $\frac{2y+1}{3} = \frac{y-2}{4}$

You must show your working.

	$\frac{2y+1}{3} = \frac{y-2}{4}$	
($\times 4$)	$\frac{4(2y+1)}{3} = y-2$	
($\times 3$)	$4(2y+1) = 3(y-2)$	
Expand	$8y+4 = 3y-6$	
($-3y$)	$5y+4 = -6$	
(-4)	$5y = -10$	$y = \dots -2$
($\div 5$)	$y = -2$	

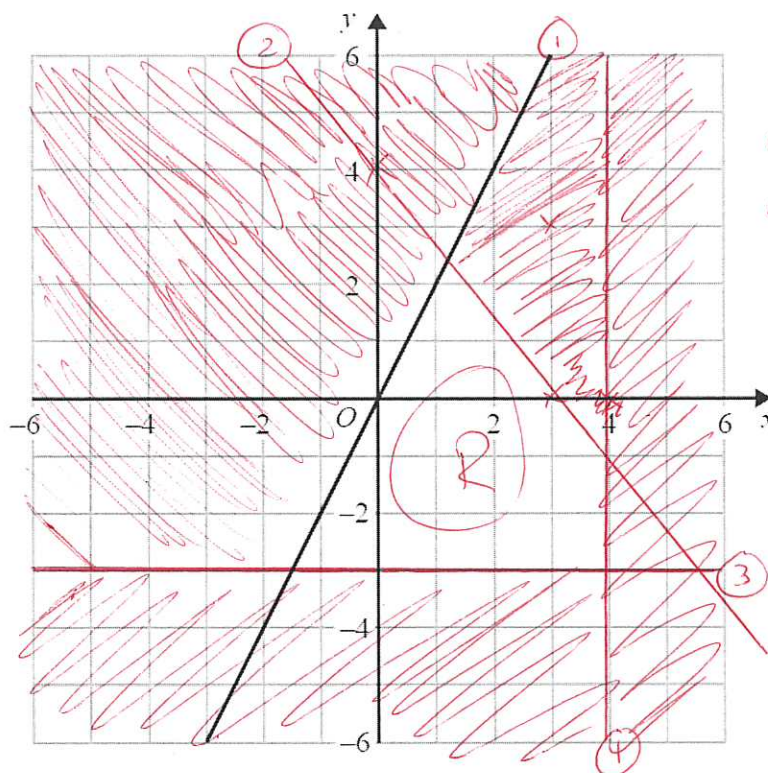
(Total for Question 11 is 4 marks)

Graphical Inequalities (Regions)

12. The line with equation $y = 2x$ is drawn on the grid.

(a) On the same grid, draw the line with equation $4x + 3y = 12$

(2)



$$4x + 3y = 12$$

$$\text{let } x = 0, \text{ then } y = 4$$

$$\text{let } y = 0, \text{ then } x = 3$$

$$(0, 4), (3, 0)$$

(b) Show, by shading on the grid, the region defined by all four inequalities

$$\textcircled{1} \quad y \leq 2x$$

$$\textcircled{2} \quad 4x + 3y \leq 12$$

$$\textcircled{3} \quad y \geq -3$$

$$\textcircled{4} \quad x \leq 4$$

Full colour lines $\geq \leq$

$$4x + 3y \leq 12$$

$$\text{TEST: } (3, 3)$$

$$12 + 9 \neq 12$$

so we do not want (3,3)

(3)

(Total for Question 12 is 5 marks)

Rearranging Complex Formula

13. Given that c is positive, make c the subject of $a = \sqrt{1 - \frac{b^2}{c^2}}$.

SQUARE	$a^2 = 1 - \frac{b^2}{c^2}$	
$(+ \frac{b^2}{c^2})$	$a^2 + \frac{b^2}{c^2} = 1$	
$(\times c^2)$	$a^2 c^2 + b^2 = c^2$	
$(-b^2)$	$a^2 c^2 = c^2 - b^2$	
$(-c^2)$	$a^2 c^2 - c^2 = -b^2$	
factorize	$c^2(a^2 - 1) = -b^2$	
$(\div (a^2 - 1))$	$c^2 = \frac{-b^2}{a^2 - 1}$	$c = \sqrt{\frac{b^2}{a^2 - 1}}$
Root	$c = \sqrt{\frac{b^2}{a^2 - 1}}$	

(Total for Question 13 is 4 marks)

Quadratic Formula

14. Alison is using the quadratic formula to solve a quadratic equation. She substitutes values into the formula and correctly gets

$$x = \frac{-7 \pm \sqrt{49 - 32}}{4}$$

Work out the quadratic equation that Alison is solving.

Give your answer in the form $ax^2 + bx + c = 0$, where a , b and c are integers.

Quadratic formula: $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

① $-b = -7 \Rightarrow \underline{b = 7}$

② $2a = 4 \Rightarrow \underline{a = 2}$

③ $4ac = 32$

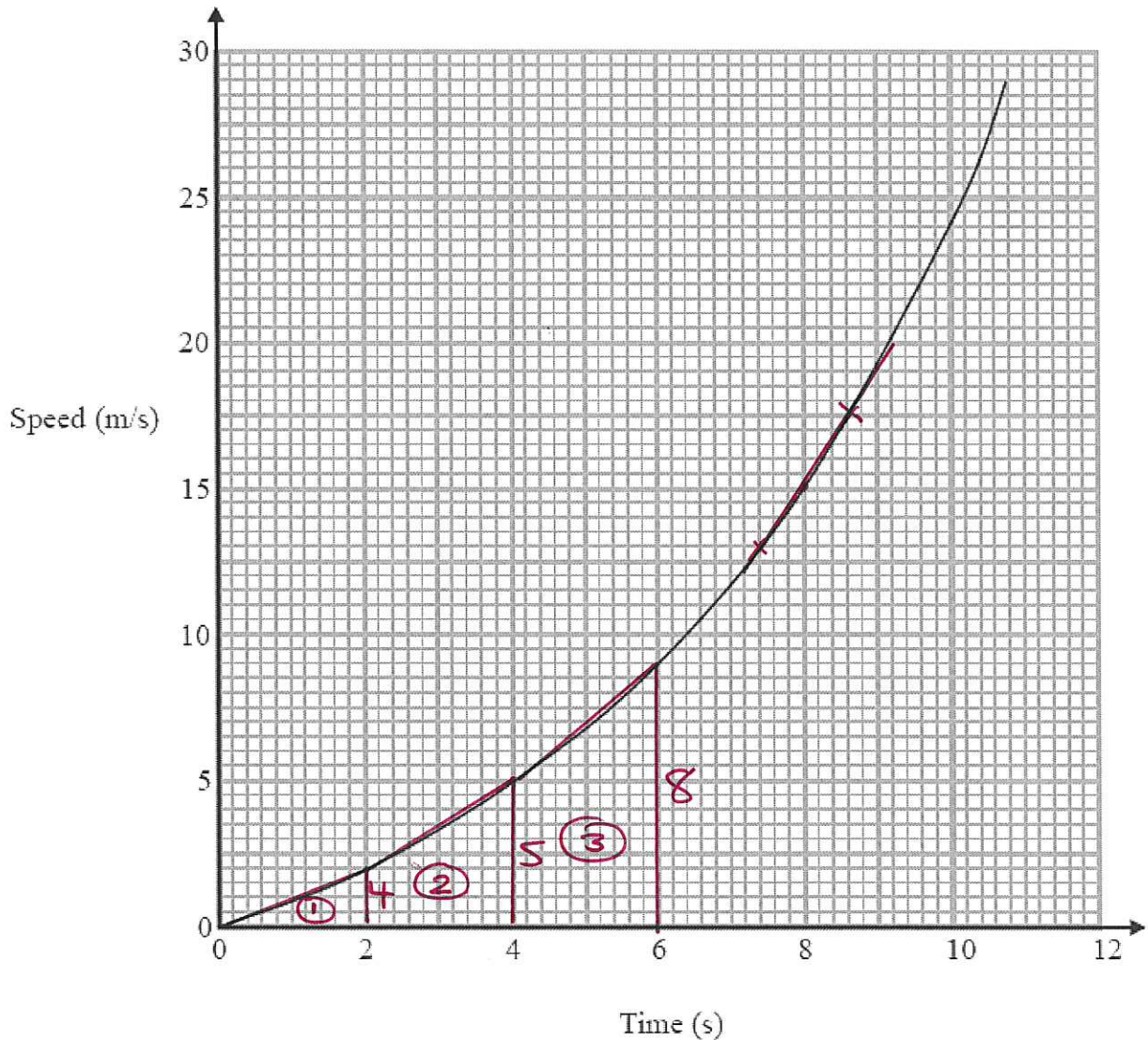
$a = 2 \dots 8c = 32 \Rightarrow \underline{c = 4}$

$$ax^2 + bx + c = 0$$

$$2x^2 + 7x + 4 = 0$$

.....
(Total for Question 14 is 3 marks)

15. Here is a speed-time graph for a car.



(a) Work out an estimate for the distance the car travelled in the first 6 seconds.

Total Distance = Area under curve

$$= \textcircled{1} + \textcircled{2} + \textcircled{3}$$

$$\textcircled{1} = \frac{b \times h}{2} = \frac{2 \times 4}{2} = 4 \text{ m}$$

$$\textcircled{2} = \frac{h(a+b)}{2} = \frac{2(4+5)}{2} = 9 \text{ m} \quad \dots\dots\dots 26 \text{ m}$$

$$\textcircled{3} = \frac{h(a+b)}{2} = \frac{2(5+8)}{2} = 13 \text{ m}$$

$$\begin{aligned} \text{Total Distance} &= 4 \text{ m} + 9 \text{ m} + 13 \text{ m} \\ &= 26 \text{ m} \end{aligned}$$

- (b) Is your answer to (a) an underestimate or an overestimate of the actual distance?
Give a reason for your answer.

overestimate since the trapeziums are taller than the function.

(1)

- (c) Calculate an estimate for the gradient of the graph when $t = 8$ seconds.
You must show how you get your answer.

gradient = acceleration

Tangent to curve... $\frac{y_2 - y_1}{x_2 - x_1} = \frac{17.5 - 13}{8.6 - 7.4} = \frac{4.5}{1.2} = \underline{\underline{3.75}}$

3.75 m s^{-2}

(2)

- (d) Describe fully what your answer to part (c) represents.

Acceleration, the rate of change of speed.

(1)

(Total for Question 15 is 7 marks)

16. There are 15 boys and 9 girls in a mixed hockey team.
One of the boys and one of the girls are going to be chosen to collect the cup.

(a) Work out the number of different pairs that can be chosen.

$$15 \times 9 = 135$$

$$\frac{135}{(2)}$$

Two of the boys are going to be chosen to play in an all boys team.
Sam thinks the number of different pairs that can be chosen is 210
Tom thinks the number of different pairs that can be chosen is 105

(b) Who is correct, Sam or Tom?
Give a reason for your answer.

Tom is correct since pair (A,B) is the same
team as team (B,A).

(1)

(Total for Question 16 is 3 marks)

17. $a : b = 5 : 8$ and $b : c = 6 : 25$

Find, in its simplest form, $a : b : c$

Combining Ratios

LCM of 8 and 6
= 24

$$\begin{array}{cc} a : b & b : c \\ 5 : 8 & 6 : 25 \\ \downarrow (\times 3) & \downarrow (\times 4) \\ 15 : 24 & 24 : 100 \end{array}$$

$$a : b : c$$

$$15 : 24 : 100$$

$$a : b : c = 15 : 24 : 100$$

(Total for Question 17 is 3 marks)

Capture Recapture

18. Rana wants to estimate the number of balls in a bag.

On Monday Rana removes 120 balls from the bag.
She puts a mark on each ball.

She then puts all 120 balls back in the bag.

On Tuesday Rana removes 20 balls from the bag.
8 of these balls have a mark on them.

Work out an estimate for the total number of balls in the bag.
You must write down any assumptions you have made.

$x = \text{Total}$

120 out of x

$$\frac{120}{x}$$

Sample :

8 out of 20.

$$\frac{8}{20}$$

Assuming sample
is appropriately
random ...

$$\frac{120}{x} = \frac{8}{20}$$

($\times 20$)

$$\frac{2400}{x} = 8$$

($\times x$)

$$2400 = 8x$$

($\div 8$)

$$300 = x$$

$$x = 300$$

(Total for question 18 is 4 marks)

Index Laws

19. $m = 8 \times 10^{9n}$, where n is an integer.

Express $m^{\frac{1}{3}}$ in standard form.

Give your answer, in terms of n , as simply as possible.

$$m = 8 \times 10^{9n}$$

$$m^{\frac{1}{3}} = (8 \times 10^{9n})^{\frac{1}{3}} = (8 \times 10^{3n} \times 10^{3n} \times 10^{3n})^{\frac{1}{3}}$$

$$\therefore m^{\frac{1}{3}} = 2 \times 10^{3n}$$

$$\text{so } m^{-\frac{1}{3}} = \frac{1}{2 \times 10^{3n}}$$

$$= 0.5 \times 10^{-3n}$$

$$= 5 \times 10^{-3n-1}$$

Standard form

$$\frac{1}{2 \times 10^{3n}} = 5 \times 10^{-3n-1}$$

.....
(Total for Question 19 is 3 marks)

Independent Event Probability

20.



Ashok has six coins in his pocket.

He has one 5 cent coin, two 10 cent coins and three 20 cent coins.

He takes at random a coin from his pocket.

He records its value and puts the coin back into his pocket.

He then takes at random a second coin from his pocket and records its value.

- (a) Calculate the probability that he takes two 20 cent coins.

$$P(20 \text{ cent}) = \frac{3}{6}$$

$$P(20 \text{ cent and } 20 \text{ cent}) = \frac{3}{6} \times \frac{3}{6} = \frac{9}{36} = \frac{1}{4} \quad \dots\dots\dots \frac{1}{4} \quad (2)$$

- (b) Calculate the probability that the second coin he takes has a higher value than the first coin he takes.

Possible permutations:

$$P(5, 10) = \frac{1}{6} \times \frac{2}{6} = \frac{2}{36} \quad (+)$$

$$P(5, 20) = \frac{1}{6} \times \frac{3}{6} = \frac{3}{36} \quad (+)$$

$$P(10, 20) = \frac{2}{6} \times \frac{3}{6} = \frac{6}{36} \quad (+)$$

$$\frac{11}{36}$$

$$\frac{11}{36}$$

(3)

(Total for Question 20 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS