

Annual Examinations for Secondary Schools 2022

YEAR 11

**MATHEMATICS
Main Paper**

TIME: 1h 40min

Question	1	2	3	4	5	6	7	8	9	10	11	12	Total Main	Non Calc	Global Mark
Mark															

DO NOT WRITE ABOVE THIS LINE.

Name: _____

Class: _____

Calculators are allowed but all necessary working must be shown.

Answer ALL questions.

Table of Formulae

Curved Surface Area of Right Circular Cone	$\pi r l$
Surface Area of a Sphere	$4\pi r^2$
Volume of a Pyramid/Right Circular Cone	$\frac{1}{3}$ base area $\times$ perpendicular height
Volume of a Sphere	$\frac{4}{3}\pi r^3$
Solutions of $ax^2 + bx + c = 0$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

1. a) Calculate $\sqrt[4]{100}$, giving your answer correct to 3 decimal places.

Ans: _____

- b) Underline the two statements that are equivalent to $x^{\frac{2}{3}}$.

A) $(\sqrt[3]{x})^2$

B) $(\sqrt[2]{x})^3$

C) $\left(\sqrt[3]{\frac{1}{x}}\right)^2$

D) $(x^2)^{\frac{1}{3}}$

(4 marks)

2. Express as a single simplified fraction:

$$\frac{x-5}{6} + \frac{4-x}{9}$$

Ans: _____

(3 marks)

3. ABCD is a parallelogram. DM and BN are both perpendicular to the diagonal AC.

- a) Show that triangle ADM is congruent to triangle CBN.

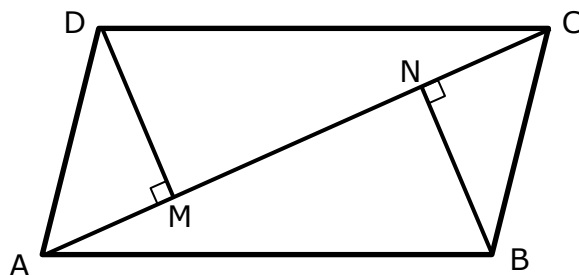


Diagram is NOT drawn to scale

- b) $AC = 20$ cm and $AM = x$ cm. Write an expression for the length of MN.

(5 marks)

4. A function is given by $f(x) = 2x - 7$.

a) i) Work out the value of $f(10)$.

Ans: _____

ii) What is the value of x when $f(x) = 6$?

Ans: $x =$ _____

b) Another function is given by $g(x) = 5x + 2$.

i) Solve the equation: $f(x) = g(x)$.

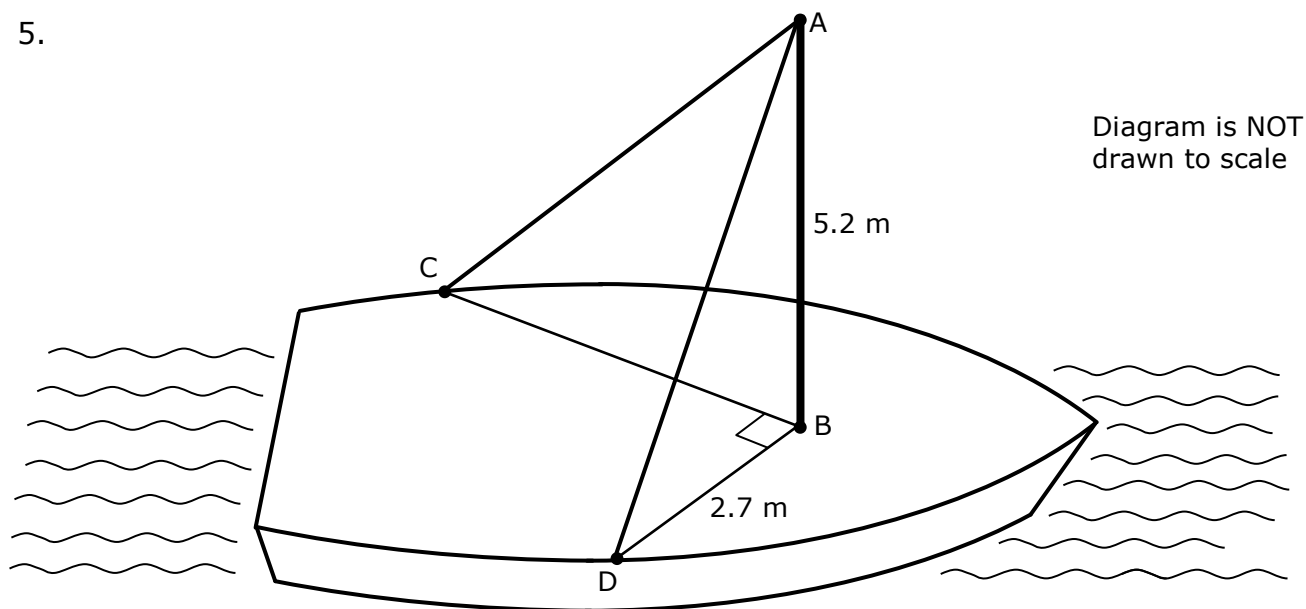
Ans: $x =$ _____

ii) Write the inverse function: $g^{-1}(x)$.

Ans: $g^{-1}(x) =$ _____

(7 marks)

5.



The diagram shows a boat with a vertical mast AB . C and D are points on the boat such that AB is perpendicular to both BC and BD . $AB = 5.2$ m and $BD = 2.7$ m.

a) Calculate the angle of elevation of A from D .

Ans: _____

b) $DC = 4.3$ m and $\angle CBD = 90^\circ$. Work out the length of a rope which runs from A to C .

Ans: _____

(8 marks)

6. a)

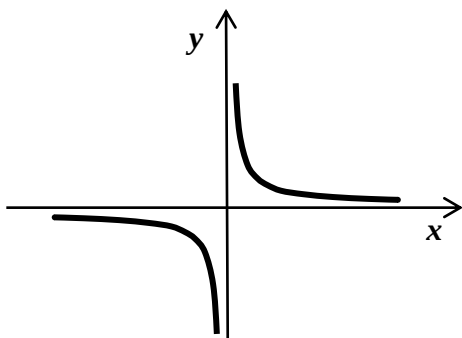
$$y = x^2 + 4$$

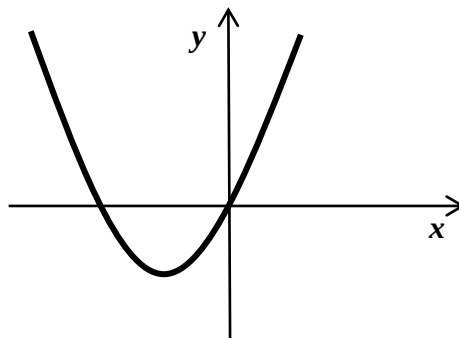
$$y = x^2 - 4$$

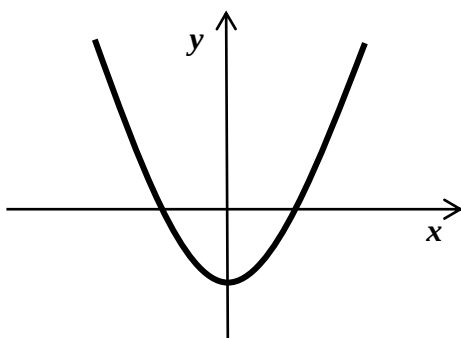
$$y = x^2 + 4x$$

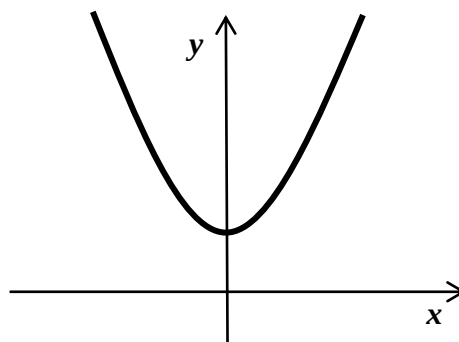
$$y = \frac{4}{x}$$

Match each of the four equations above with the corresponding sketches below:









- b) The equation $x^3 + x^2 = 50$ has a solution between 3 and 4. Use trial and improvement to find this solution correct to 1 decimal place. Show your working.

(5 marks)

7. Points A and B are located exactly in the same position. Both points start moving at the same time in opposite directions. Point A moves at 5 m/s while Point B moves at 3 m/s. Both speeds are rounded to the nearest m/s. Is it possible that A and B are exactly 7 m apart after 1 second? Explain.

(4 marks)

8.

Recommended daily amount of iron needed		
Age (years)	Males	Females
15-18	11 mg	15 mg
19-50	9 mg	15 mg

Iron content in Food		
Food	Amount (grams)	Iron Content (milligrams)
Chicken Liver	100 g	8.8 mg
Beef	100 g	5.5 mg
Broccoli	100 g	0.75 mg
Spinach	100 g	2.8 mg
Pasta	240 g	2.0 mg
Potatoes	100 g	0.8 mg

- a) Thea is 17 years old. Her plate contains 200 g of beef and 300 g of broccoli.
- i) How much iron, in mg, does the food in her plate contain?

Ans: _____

- ii) Mention **one other** type of vegetable and its least amount that Thea may add to her plate to reach her recommended daily amount of iron. Explain.

Ans: _____ g of _____ (vegetable)

- b) Bradley is 22 years old. On Monday he gets 5 mg of iron.

- i) What percentage of the daily amount needed, does Bradley get on Monday?

Ans: _____

- ii) On Tuesday Bradley gets 8.5 mg of iron.
What is the percentage increase in the amount of iron he got?

Ans: _____

(8 marks)

9. a) Complete the table below for the equation $y = x^3 - 4x^2 + x + 2$.

x	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5	4
y	-4	0.375	2	1.625	0	-2.125	-4	-4.875	-4		6

b) Use the graph paper on the opposite page to plot the graph of $y = x^3 - 4x^2 + x + 2$.

c) From your graph, read the x value of the points where the graph cuts the x -axis.

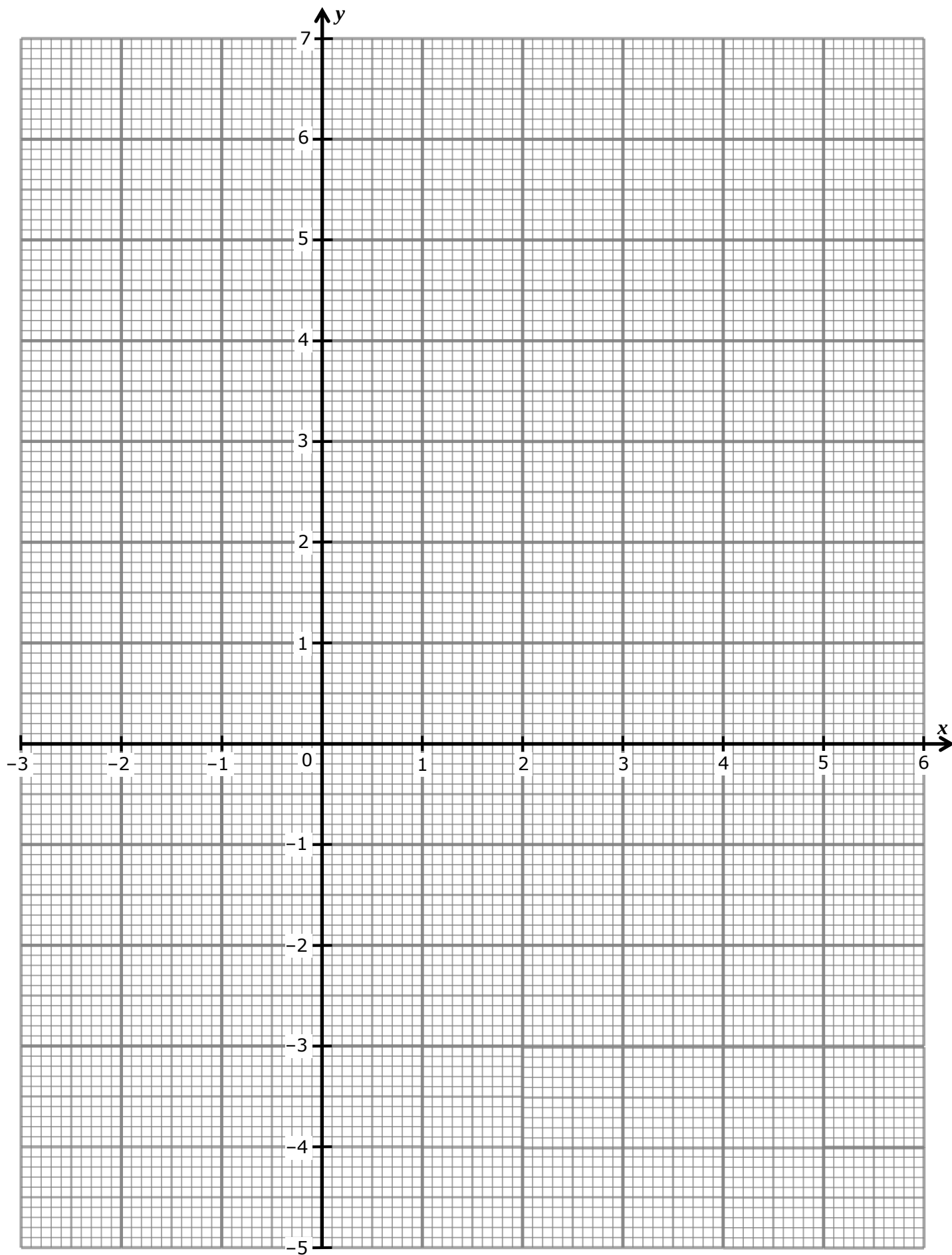
Ans: $x =$ _____; $x =$ _____; $x =$ _____.

d) i) On the same axes, plot a straight line graph such that both graphs can be used to solve the equation below.

$$x^3 - 4x^2 + x + 2 = \frac{1}{2}x$$

ii) Solve the equation $x^3 - 4x^2 + x + 2 = \frac{1}{2}x$ by using both graphs.

Ans: $x =$ _____; $x =$ _____; $x =$ _____.

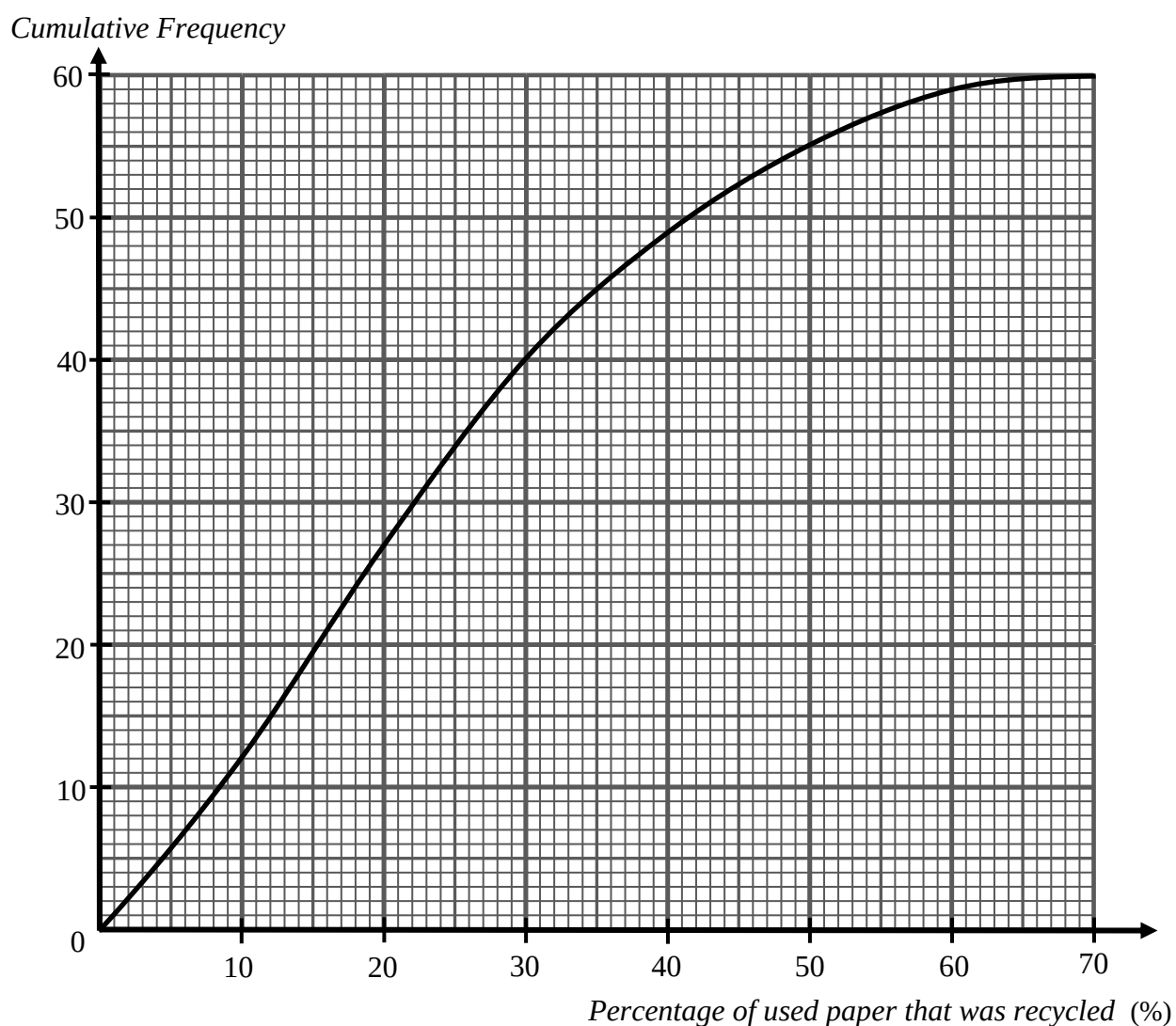


(13 marks)

10. The incomplete table on the right shows the percentage of used paper that was recycled by a group of countries in 2013.

The graph below shows the cumulative frequency curve for this data.

Percentage (p) of used paper that was recycled	Frequency	Cumulative Frequency
$0\% < p \leq 10\%$	12	12
$10\% < p \leq 20\%$	15	27
$20\% < p \leq 30\%$	13	40
$30\% < p \leq 40\%$		
$40\% < p \leq 50\%$		
$50\% < p \leq 60\%$		
$60\% < p \leq 70\%$	1	60



- a) Use the curve to complete the table above.
- b) How many countries were considered in this data?

Ans: _____

- c) Use the curve to estimate the median percentage of used paper that was recycled.

Ans: _____

- d) Germany was one of the countries considered in the data above. It recycled 65% of its used paper. Can it be stated that Germany was the country which recycled **most** used paper in the group? Explain.

_____ (7 marks)

11. In a box there are x green beads and $(2x + 2)$ pink beads. A bead is to be picked at random from the box.

- a) Use the information above to write down the probability of picking a green bead in terms of x . Simplify your answer.

Ans: _____

- b) The probability of picking a green bead can also be expressed as $\frac{12 - x}{13}$.

Use this information and the answer in part a) to show that $x^2 - 7x - 8 = 0$.

- c) i) Solve the equation $x^2 - 7x - 8 = 0$.

- ii) Determine the total number of beads in the box.

Ans: _____ beads
(8 marks)

12.

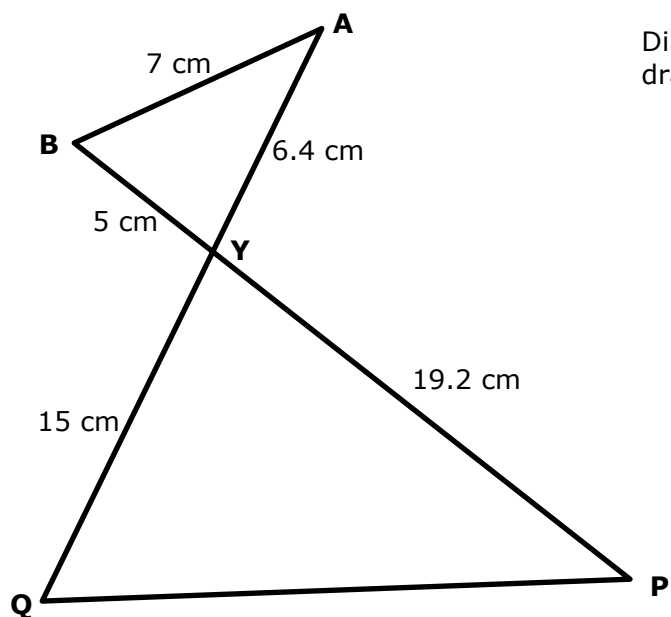


Diagram is NOT drawn to scale

AQ and BP are two straight lines intersecting at Y.

a) Show that triangle ABY is similar to triangle PQY.

b) Calculate the length of PQ.

Ans: _____

c) $\angle ABY = 72^\circ$ and $\angle BYA = 68^\circ$. What is the value of $\angle YPQ$?

Ans: _____

d) Prove that the points A, B, P and Q lie on a circle.

(8 marks)

END OF EXAMINATION