

Centre Number	Candidate Number	Name
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MINISTRY OF EDUCATION, BOTSWANA
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

Botswana General Certificate of Secondary Education

MATHEMATICS **0563/02**

Paper 2 October/November 2006

Candidates answer on the Question Paper. **2 hours**
Additional Materials: Geometrical instruments
Electronic calculator

Read the following carefully before you start.

Write your centre number, candidate number and name in the spaces provided at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on this question paper.

If working is needed for any question it must be shown below that question. Omission of essential working will result in loss of marks.

Do not use staples, paper clips, highlighters, glue or correction fluid.

The number of marks is given in brackets [] at the end of each question or part question.

The total of the marks for this paper is 75.

If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given to one decimal place.

In any question where the value of π is required, use the value from your calculator or take π as 3.142.

For Examiner's Use

Mathematical formulae for papers 1 and 2

Surface area and volume of solids

Name of solid	Total surface area	Volume
cone	$\pi r^2 + \pi r l$	$\frac{1}{3} \pi r^2 h$
pyramid		$\frac{1}{3}$ base area \times height
sphere	$4\pi r^2$	$\frac{4}{3} \pi r^3$

Trigonometry

Sine Rule $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Area of a triangle $= \frac{1}{2} ab \sin C$

- 1 A tank was filled with water in 5 hours 24 minutes. At 1005 the tank was completely filled up.
- (a) At what time did the tank start filling up?
 - (b) Express 5 hours 24 minutes in hours.
 - (c) The tank was filled by a pump working at the rate of 0.4 m^3 per hour. How long, in hours and minutes, would it take if the pump was working at 0.9 m^3 per hour?

Answer (a) [2]
 (b) hours [1]
 (c)..... hours minutes [2]

2 Evaluate $\frac{17.9 \times 3.84}{8.07 + \sqrt{19.2}}$.

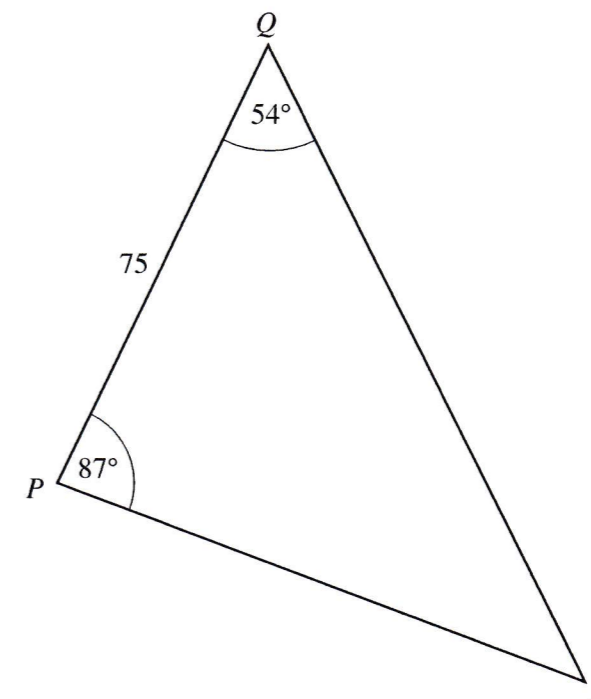
Answer [2]

3 Make b the subject of the formula

$$A = \frac{1}{2}bh.$$

Answer [2]

- 4 Simon's garden is in the form of a triangle PQR as shown. $PQ = 75 \text{ m}$, $\hat{P}R = 87^\circ$ and $\hat{Q}R = 54^\circ$.



Calculate

- (a) (i) $\hat{P}RQ$,
- (ii) the length of PR .

To reduce the number of predators entering the garden, Simon puts one line of razor wire along PQ and PR .

- (b) Calculate the total length of the razor wire.

Answer (a) (i)..... [1]
 (ii)..... m [3]
 (b)..... m [1]

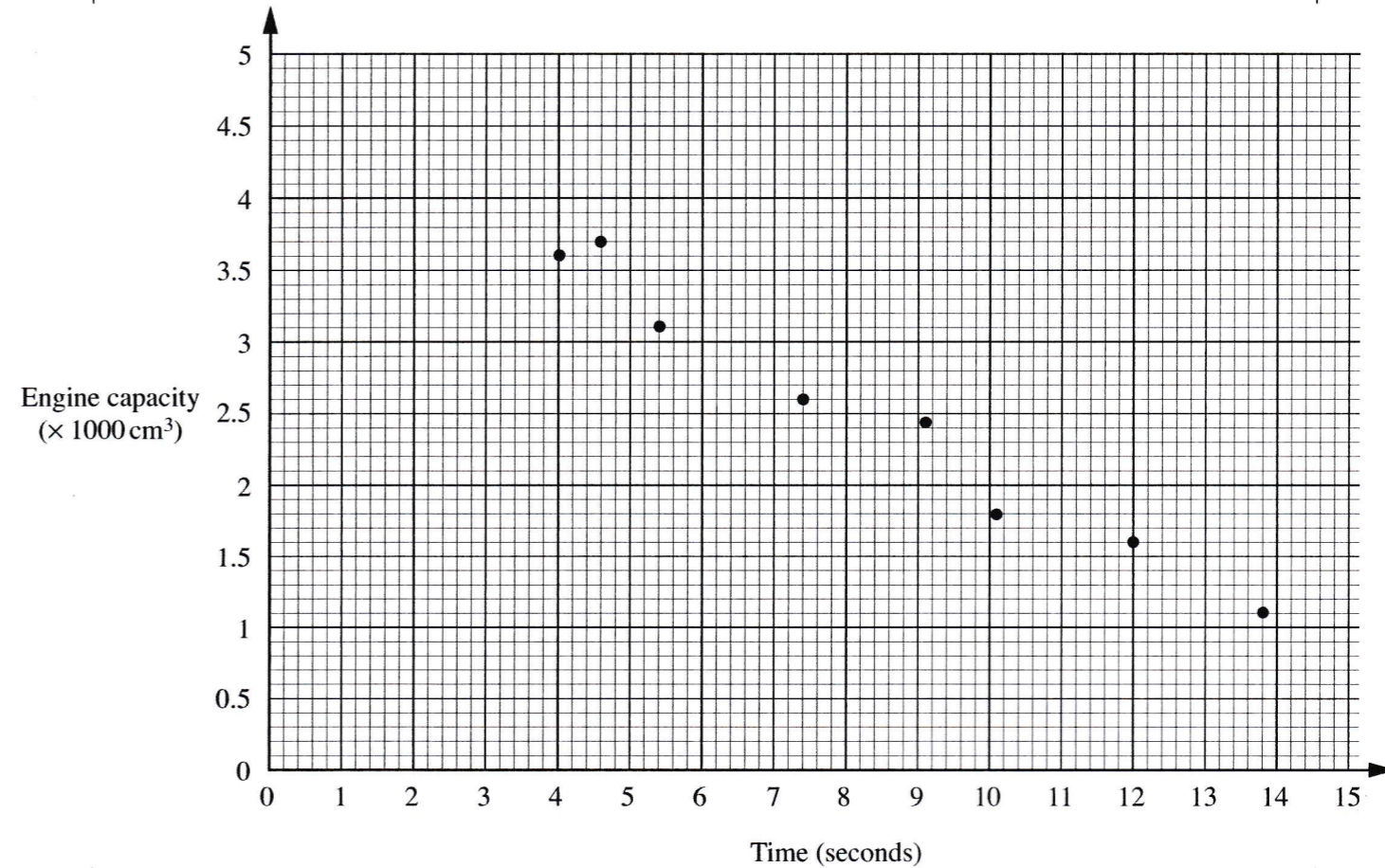
5 Water is charged per kilolitre (kl) as shown in the table below.

Tariff band	Consumption /month (kl)	Thebe per kl				
		Gaborone /Lobatse	Jwaneng	Francistown	Sua township	Selibe Phikwe
1	0 – 10	235	185	265	185	185
2	11 – 15	705	365	635	415	295
3	16 – 25	900	475	925	595	365
4	Above 25	1245	545	1035	660	475

- (a) (i) What is the water charge per kl in Selibe Phikwe in tariff band 2?
(ii) How much more is the water charge per kl in Francistown than in Selibe Phikwe in tariff band 2?
- (b) A household in Jwaneng consumed 18 kl of water.
(i) Calculate the charge for the water consumed.
The water bill is the charge for the water consumed plus 10% Value Added Tax (VAT).
(ii) Calculate the water bill for the household.
- (c) The water charge (without VAT) for a household in Sua township is P35.10.
Calculate the number of kl of water consumed by the household.

Answer (a) (i) P [1]
(ii) P [1]
(b) (i) P [2]
(ii) P [2]
(c)kl [2]

6 The scatter graph below shows the engine capacity of cars and the time it takes a car to accelerate from 0 to 100 km/h.



- (a) State the type of correlation between the engine capacity and the time taken to accelerate from 0 to 100 km/h.
- (b) Draw the line of best fit. [1]
- (c) A car has an engine capacity of 2100 cm^3 .
Using your line of best fit, estimate the time, in seconds, the car is expected to take to accelerate from 0 to 100 km/h.

Answer (a) [1]
(c) [1]

7 A group of students, consisting of 58 boys and 62 girls in a school, reported that they either use a family car, public transport or walk to school. The table below shows this information.

	Family Car	Public Transport	Walk
Boys	8	20	30
Girls	15	25	22

- (a) What percentage of the students uses public transport?
- (b) The information is to be represented in a pie chart.
[You are not expected to draw a pie chart.]
Calculate the sector angle for students who use a family car.
- (c) A student is chosen at random from the group.
Find the probability that the student
- (i) walks to school,
 - (ii) is a girl who does **not** use public transport.

Answer (a) [2]
 (b) [2]
 (c) (i) [1]
 (ii) [2]

8 Three siblings, Thabo, Dineo and Mbora share a herd of cattle from their father's heritage. Mbora receives x cattle. Dineo receives three times the number of cattle received by Mbora.

(a) Write down an expression, in terms of x , for the number of cattle received by Dineo.

Thabo receives 360 cattle more than Dineo.

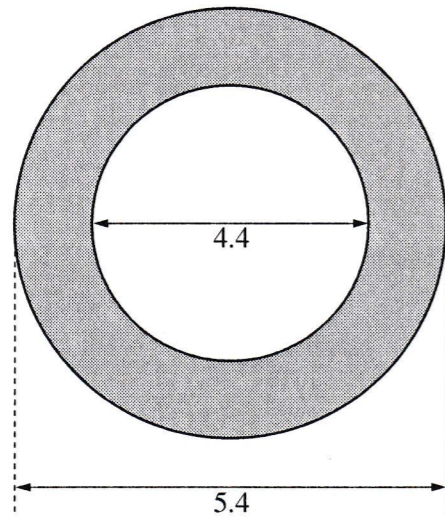
(b) Write down an expression, in terms of x , for the number of cattle received by Thabo.

The total number of cattle received by the siblings is 1200.

- (c) (i) Form an equation in x to represent this information and show that it reduces to $7x = 840$.
 (ii) Solve the equation $7x = 840$.
 (iii) How many cattle did Thabo receive?

Answer (a) [1]
 (b) [1]
 (c) (i) [2]
 (c) (ii) [1]
 (iii) [1]

9 The diagram shows the cross-section of a cylindrical tunnel with internal diameter 4.4 m and external diameter 5.4 m.



Calculate

- (a) the area of the circular opening of the tunnel,
- (b) the shaded area,
- (c) the volume of the material in a 2.5 m stretch of the tunnel.

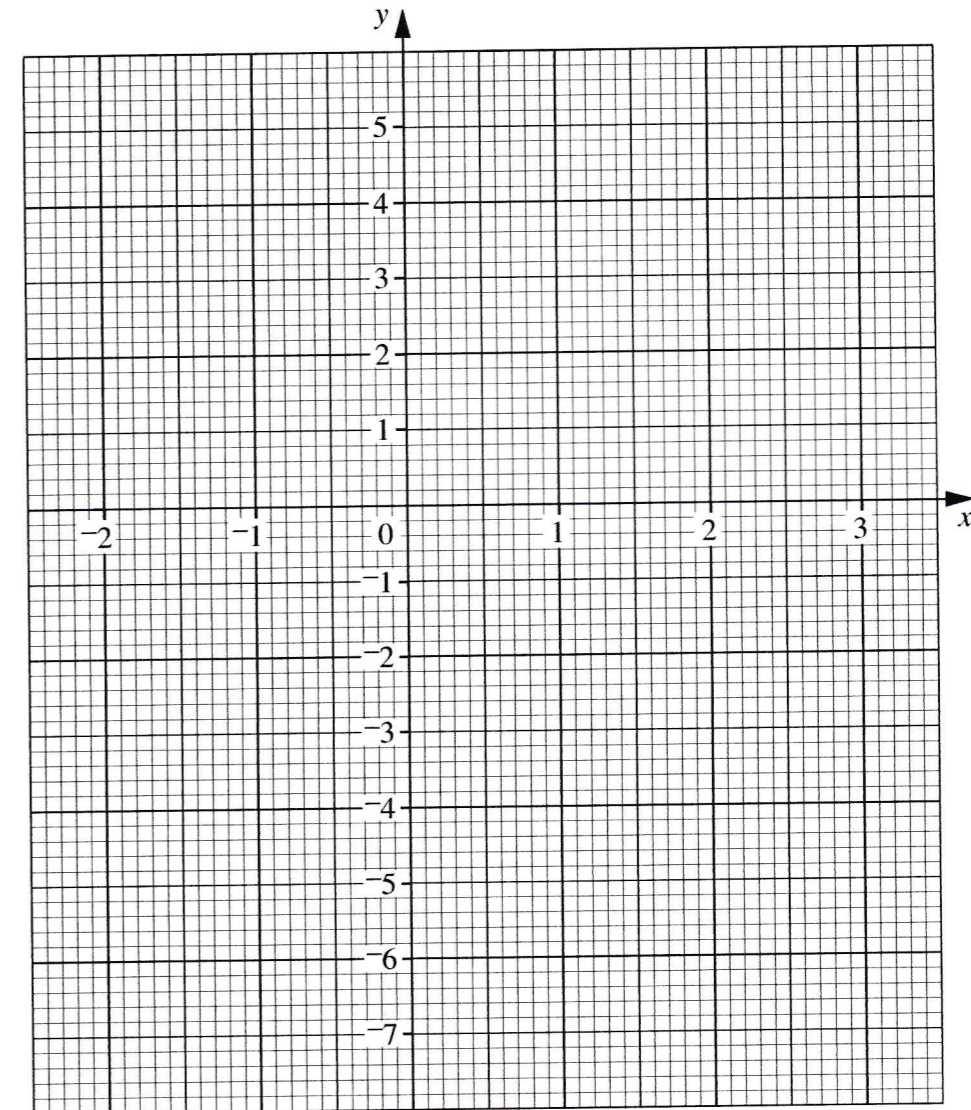
Answer (a) m² [2]
 (b) m² [3]
 (c) m³ [2]

10 The table below shows some values of x and the corresponding values of $f(x)$, correct to one decimal place, for the function $f(x) = x^3 - 2x^2 + 1$.

x	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5
$f(x)$	-6.9	-2	0.4	1	0.6	0	-0.1	1	p

- (a) Find the value of p .
- (b) (i) On the axes below, draw the graph of $f(x) = x^3 - 2x^2 + 1$.

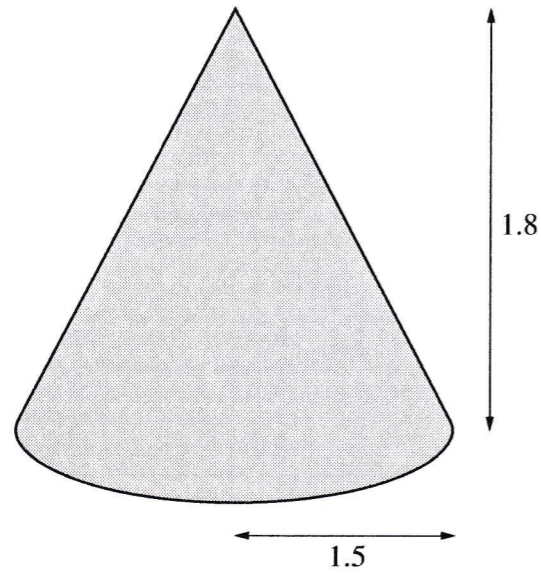
[3]



- (ii) Write down the minimum value of $f(x)$ for $x > 0$.
- (iii) The graph crosses the x -axis at three points $(r, 0)$, $(1, 0)$ and $(s, 0)$. Write down the value of r and the value of s .

Answer (a) [1]
 (b) (ii) [1]
 (iii) $r =$ $s =$ [2]

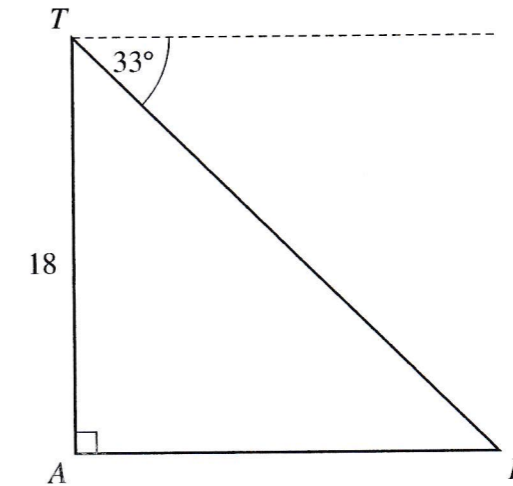
11 A heap of sand is in the form of a cone of base radius 1.5 m and height 1.8 m as shown in the diagram below.



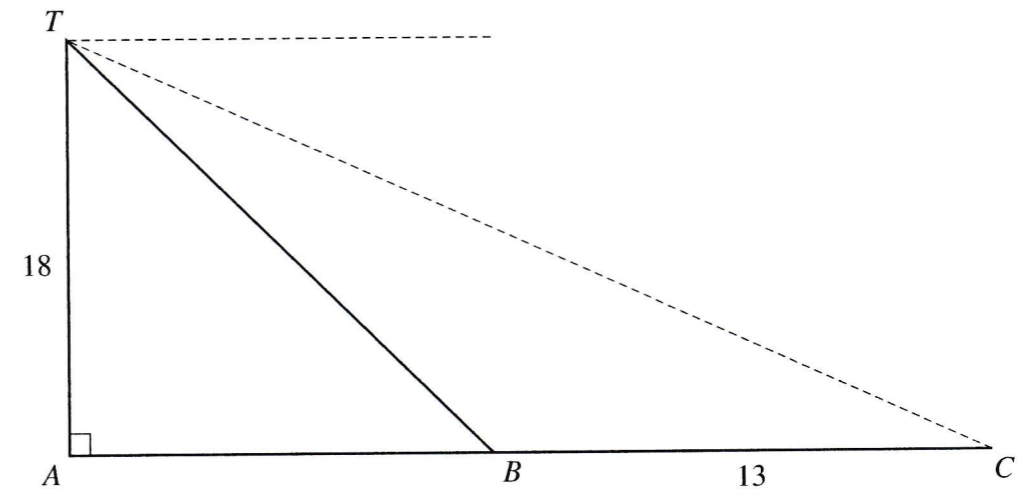
- (a) Calculate the volume of the sand.
- (b) The sand was dug out from a level surface creating a rectangular cross-sectional pit with base measuring 2.3 m by 1.7 m. Calculate the depth of the pit.
- (c) If the 2.3 m in part (b) is given correct to the nearest tenth of a metre, state its upper bound.

Answer (a) m³ [2]
 (b) m [3]
 (c) m [1]

12 In the diagram, AT represents a side of a vertical building 18 m high. The angle of depression of a car at B from the top of the building, T , is 33° and angle $TAB = 90^\circ$.



- (a) Calculate AB , the distance of the car from the foot of the building.
- (b) The car now moves in a straight line, a distance of 13 m from B to C as shown in the diagram below.

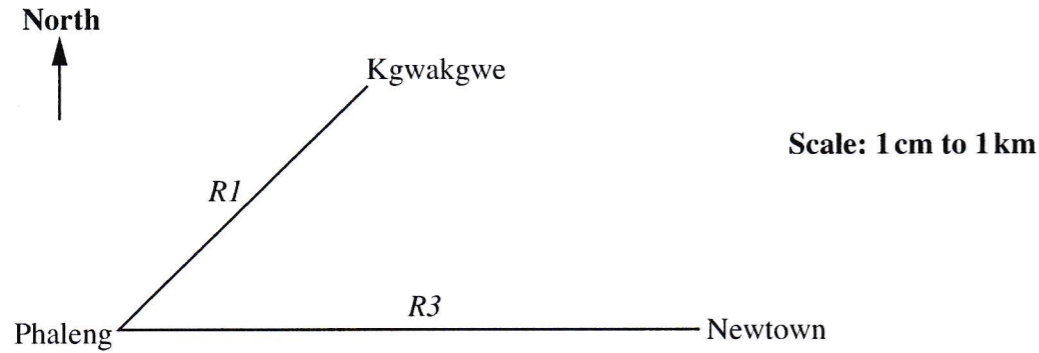


Calculate

- (i) the angle of depression of C from T ,
- (ii) the distance of the car from the top of the building T .

Answer (a) m [2]
 (b) (i) [3]
 (ii) m [2]

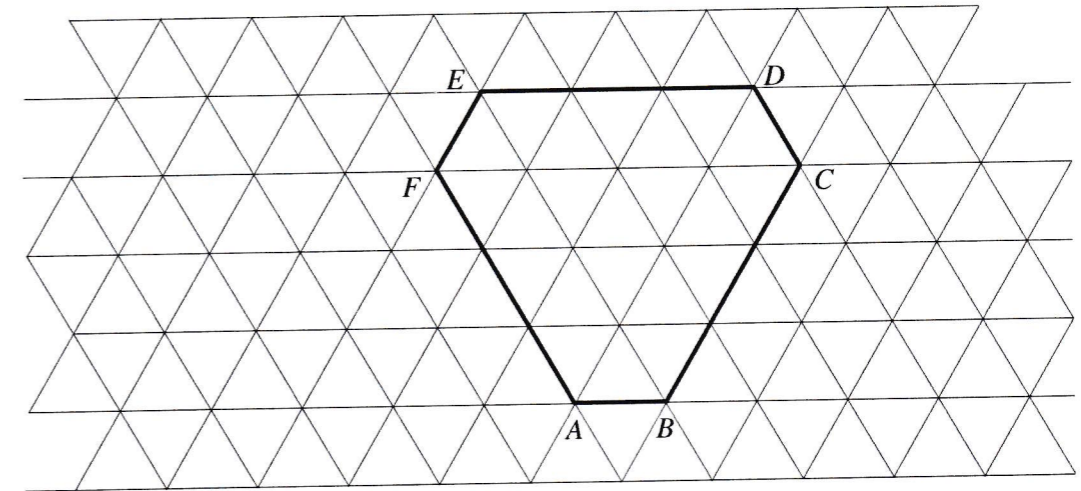
13 The diagram below shows the positions of three locations, Phaleng, Kgwakgwe and Newtown in a city. Kgwakgwe and Newtown are joined to Phaleng by straight roads *R1* and *R3* respectively.



- (a) A police patrol tower is such that it is the same distance away from the two roads. **Showing all construction lines**, construct, on the diagram, all the possible positions of the tower. [2]
- (b) A cinema hall is to be constructed south of the *R3* road such that it is 2 km away from the road. Construct, on the diagram, all the possible positions of the hall. [2]
- (c) Write down the geometrical term used to describe the relationship between the construction in part (b), and the *R3* road.

Answer (c) [1]

14 The diagram shows a hexagon *ABCDEF* on a grid made of equilateral triangles.

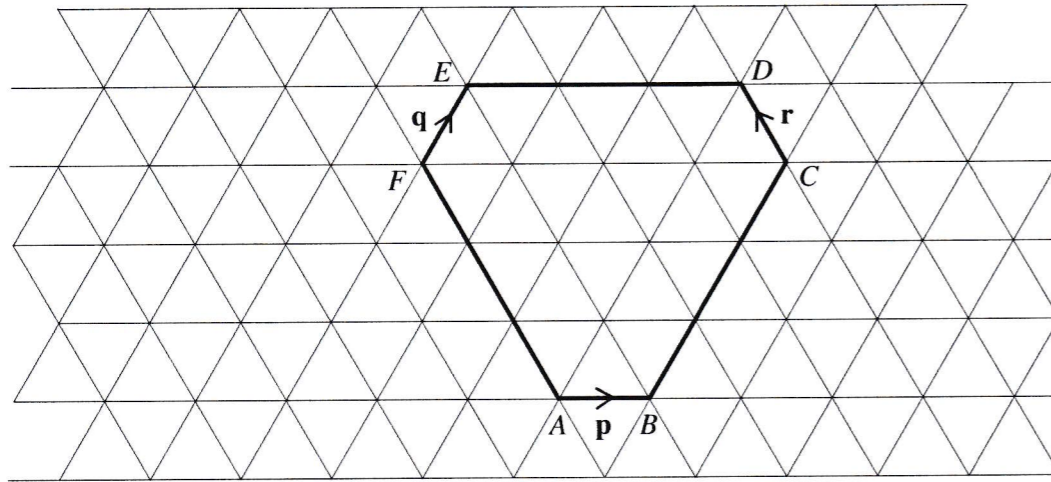


- (a) Draw all the lines of symmetry of the hexagon on the diagram above. [1]
- (b) Write down the size of angle *FBD*.

Answer (b) [1]

(c) The hexagon $ABCDEF$ is such that

$\vec{AB} = \mathbf{p}$, $\vec{FE} = \mathbf{q}$ and $\vec{CD} = \mathbf{r}$ as shown below.



Express, in terms of \mathbf{p} , \mathbf{q} and/or \mathbf{r} ,

- (i) \vec{ED} ,
- (ii) \vec{AF} ,
- (iii) \vec{AE} .

Answer (c) (i) [1]

(ii) [1]

(iii) [1]

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