

## Topic test 5

# Investigating geometry

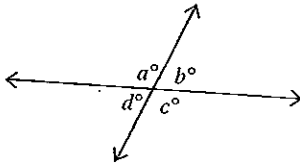
- Time allowed: 45 minutes
- Part A: 20 multiple-choice questions (40 marks)
- Part B: 18 free-response questions (60 marks)

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

### Part A

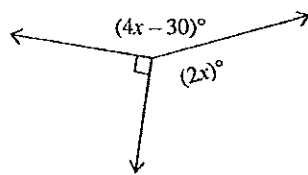
20 multiple-choice questions  
2 marks each: 40 marks  
Circle the correct answer.

Questions 1 and 2 refer to this diagram.

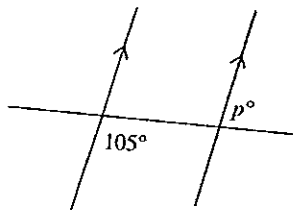


- 1 Angles  $a$  and  $c$  are:
- A alternate
  - B complementary
  - C supplementary
  - D vertically opposite
- 2 Angles  $a$  and  $d$  are:
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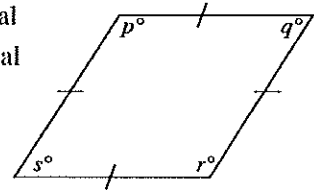
- 3 Find  $x$ .
- A  $x = 25$
  - B  $x = 38$
  - C  $x = 50$
  - D  $x = 65$



- 4 Find  $p$ .
- A  $p = 75$
  - B  $p = 255$
  - C  $p = 85$
  - D  $p = 105$



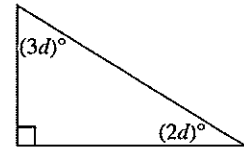
- 5 Which statement is true about this rhombus?
- A  $p$  and  $q$  are complementary
  - B  $p$  and  $r$  are supplementary
  - C  $p$  and  $r$  are equal
  - D  $p$  and  $q$  are equal



- 6 How many acute angles are in an obtuse-angled triangle?
- A 0
  - B 1
  - C 2
  - D 3

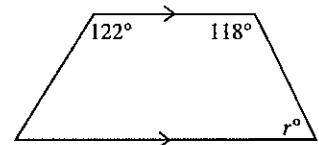
- 7 Find  $d$ .

- A  $d = 10$
- B  $d = 50$
- C  $d = 18$
- D  $d = 36$



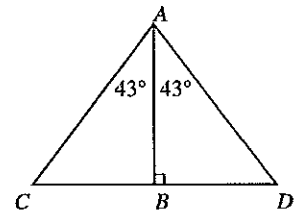
- 8 Find  $r$ .

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- B  $r = 62$
- C  $r = 122$
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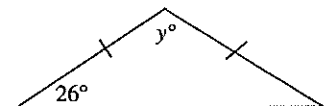
- 9 Which congruence test proves that  $\triangle ABC \cong \triangle ABD$ ?

- A SSS
- B SAS
- C AAS
- D RHS



- 10 Find  $y$ .

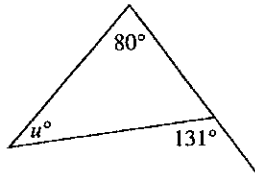
- A  $y = 64$
- B  $y = 77$
- C  $y = 128$
- D  $y = 154$



**Topic test 5: Investigating geometry continued**

11 Find  $u$ .

- A  $u = 31$
- B  $u = 49$
- C  $u = 80$
- D  $u = 51$



12 Which statement is most correct about the diagonals of a parallelogram?

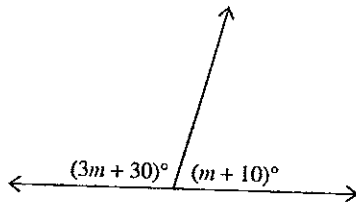
- A The diagonals are equal
- B The diagonals bisect each other
- C The diagonals bisect each other at right angles
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13 Which quadrilateral has two axes of symmetry?

- A kite
- B parallelogram
- C square
- D rectangle

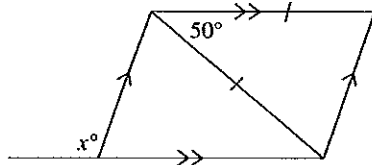
14 Find  $m$ .

- A  $m = 35$
- B  $m = 45$
- C  $m = 55$
- D  $m = 70$



15 Find  $x$ .

- A  $x = 115$
- B  $x = 65$
- C  $x = 130$
- D  $x = 155$



16 A rhombus is *not* a special type of:

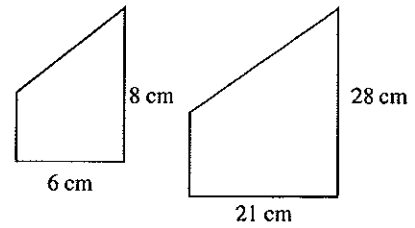
- A rectangle
- B parallelogram
- C kite

17 Which statement is false?

- A All circles are similar
- B All equilateral triangles are similar
- C All parallelograms are similar
- D All squares are similar

18 What is the scale factor of this pair of similar trapeziums?

- A  $2\frac{1}{2}$
- B  $2\frac{1}{3}$
- C  $1\frac{1}{3}$
- D  $3\frac{1}{2}$

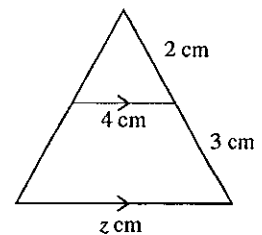


19 Find the angle sum of a nonagon (9 sides).

- A  $1260^\circ$
- B  $1440^\circ$
- C  $3240^\circ$
- D  $1620^\circ$

20 Find  $z$ .

- A  $z = 6$
- B  $z = 7$
- C  $z = 9$
- D  $z = 10$

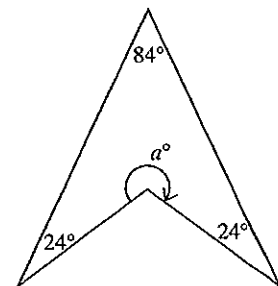


**Part B**

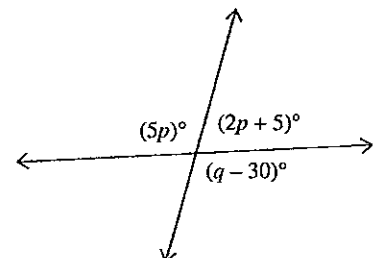
18 free-response questions  
60 marks

Show working and give reasons where appropriate.

21 (2 marks) Find  $a$ .



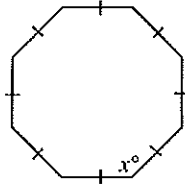
22 (4 marks) Find  $p$  and  $q$ .



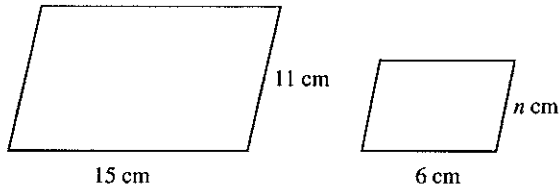
23 (2 marks) Draw a non-convex quadrilateral.

**Topic test 5: Investigating geometry continued**

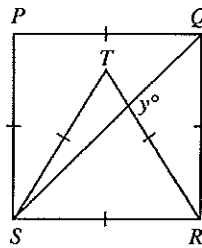
24 (2 marks) Find  $x$ .



25 (2 marks) Find  $n$  if the parallelograms are similar.

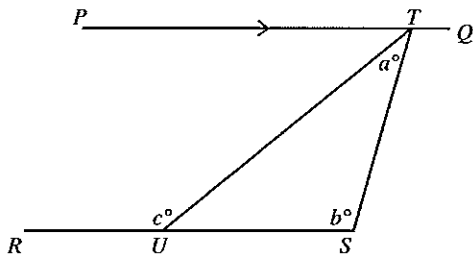


26 (3 marks) Find  $y$  if  $PQRS$  is a square.



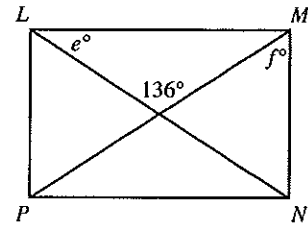
27 (2 marks) Name the most general quadrilateral to have four equal sides.

28 (6 marks) In the diagram,  $PQ \parallel RS$  and  $c^\circ$  is the size of an exterior angle of  $\triangle TSU$ .



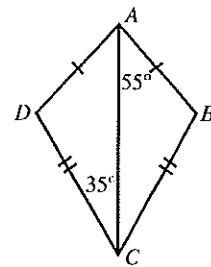
- Explain why  $\angle QTS = \angle TSU = b^\circ$ .
- What type of angles are  $\angle QTU$  and  $\angle TUR$ ?
- Hence prove that the exterior angle of  $\triangle TSU$  is equal to the sum of the two interior opposite angles.

29 (4 marks) Find  $e$  and  $f$  if  $LMNP$  is a rectangle.



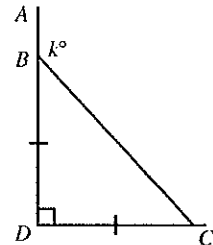
30 (2 marks) The exterior angle of a polygon is  $24^\circ$ . How many sides has the polygon?

31 (4 marks)  $ABCD$  is a kite.  
a Which congruence test proves that  $\triangle ABC \equiv \triangle ADC$ ?

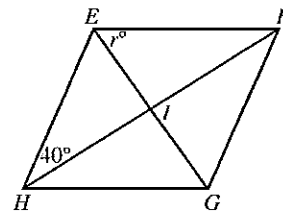


b Hence find the size of  $\angle D$ .

32 (2 marks) Find  $k$ .

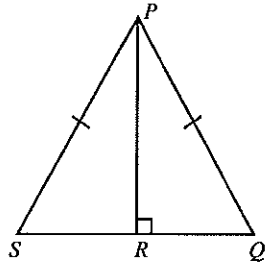


33 (2 marks) Find  $r$  if  $EFGH$  is a rhombus.



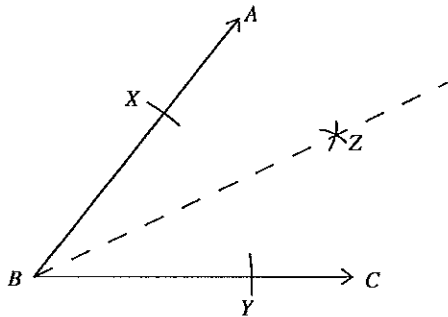
**Topic test 5: Investigating geometry continued**

34 (4 marks)  $\triangle PQS$  is isosceles with  $PS = PQ$ .



- a Which congruence test can be used to prove that  $\triangle PSR \cong \triangle PQR$ ?
- b Hence prove that the angles opposite the equal sides in an isosceles triangle are equal.

35 (4 marks)

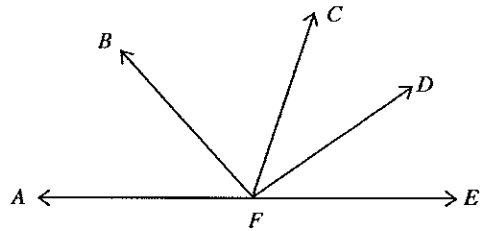


$\angle ABC$  has been bisected using compasses in the following manner:

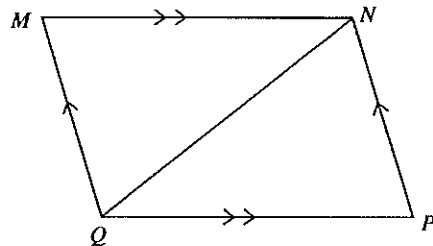
- With the compass point at  $B$ , mark points  $X$  and  $Y$ .
  - With the compass point at  $X$ , and the same radius, draw an arc.
  - With the compass point at  $Y$ , and the same radius, draw another arc.
  - Let the two arcs intersect at  $Z$ .
  - Join  $Z$  to  $B$  to bisect  $\angle ABC$ .
- a What type of quadrilateral is  $BXZY$ ? Give reasons.
- b Which property of this quadrilateral has been used to bisect  $\angle ABC$ ?

36 (2 marks) Jason, who is 1.8 metres tall, casts a shadow 2.5 metres long while a flagpole casts a shadow 11.25 metres long. How tall is the flagpole?

37 (3 marks) In the diagram,  $\angle AFC = 2x^\circ$  and  $\angle CFE = 2y^\circ$ .  $BF$  bisects  $\angle AFC$  and  $DF$  bisects  $\angle CFE$ . Prove that  $\angle BFD$  is a right angle.



38 (10 marks)  $MNPQ$  is a parallelogram with  $MN \parallel QP$  and  $MQ \parallel NP$ .



- a Why is  $\angle MNQ = \angle NQP$ ?
- b Which angle is equal to  $\angle MQN$ ?
- c Which congruence test can be used to prove that  $\triangle MNQ \cong \triangle PQN$ ?
- d Hence, which angle is equal to  $\angle M$ ?
- e What property of a parallelogram does this prove?

**END OF TEST.**

## Topic test 5

# Investigating geometry

- Time allowed: 45 minutes
- Part A: 20 multiple-choice questions (40 marks)
- Part B: 18 free-response questions (60 marks)

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

*SOLUTIONS :*

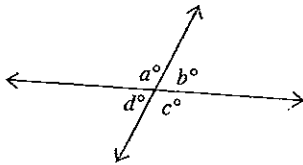
### Part A

20 multiple-choice questions

2 marks each: 40 marks

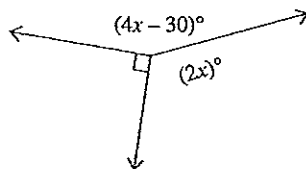
Circle the correct answer.

Questions 1 and 2 refer to this diagram.

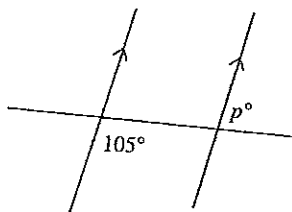


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- A alternate
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- 3 Find  $x$ .
- A  $x = 25$
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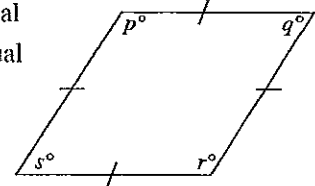


- 4 Find  $p$ .
- A  $p = 75$
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  - D  $p = 105$



- 5 Which statement is true about this rhombus?

- A  $p$  and  $q$  are complementary
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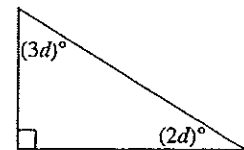


- 6 How many acute angles are in an obtuse-angled triangle?

- A 0
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- C 2
- D 3

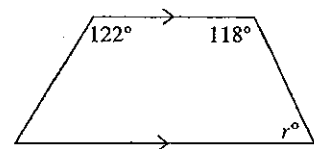
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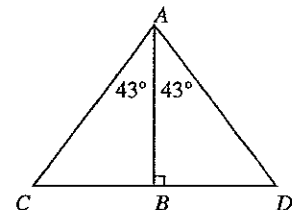
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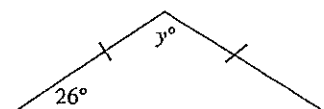
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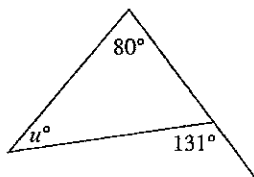
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**Topic test 5: Investigating geometry continued**

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- B  $u = 49$
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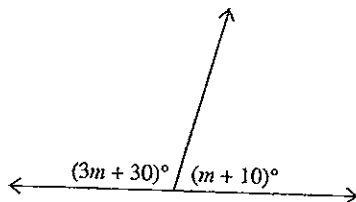
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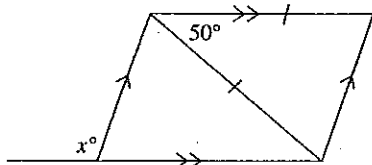
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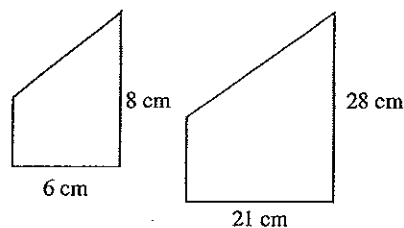
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- D All squares are similar

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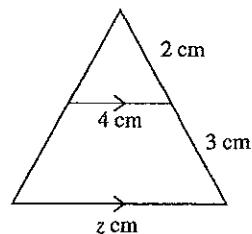


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**Part B**

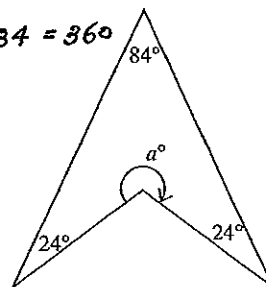
18 free-response questions  
60 marks

Show working and give reasons where appropriate.

21 (2 marks) Find  $a$ .

$$a + 24 + 24 + 84 = 360$$

$$\therefore a = 228$$



22 (4 marks) Find  $p$  and  $q$ .

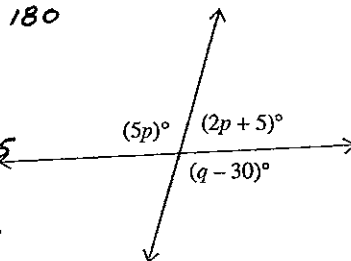
$$5p + 2p + 5 = 180$$

$$7p = 175$$

$$p = 25$$

$$q - 30 = 5 \times 25$$

$$\therefore q = 155$$



23 (2 marks) Draw a non-convex quadrilateral.

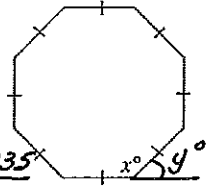


Concave or  
Non-convex  
Quadrilateral.

**Topic test 5: Investigating geometry continued**

24 (2 marks) Find  $x$ .  
using ext.  $\angle$  sum  
of a regular  
polygon

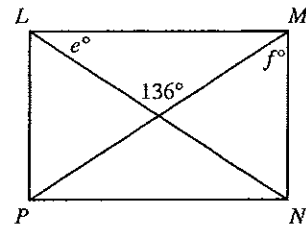
$8y = 360$   
 $y = 45 \therefore x = 135$



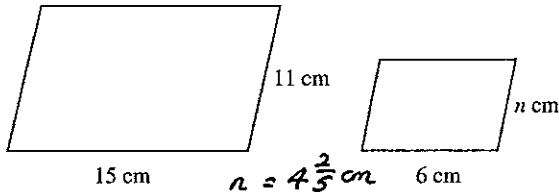
29 (4 marks) Find  $e$  and  $f$  if  $LMNP$  is a rectangle.

$e = 22$

$f = 68$



25 (2 marks) Find  $n$  if the parallelograms are similar.



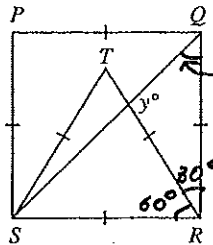
$n = 4\frac{2}{3} \text{ cm}$

30 (2 marks) The exterior angle of a polygon is  $24^\circ$ . How many sides has the polygon?

15

26 (3 marks) Find  $y$  if  $PQRS$  is a square.

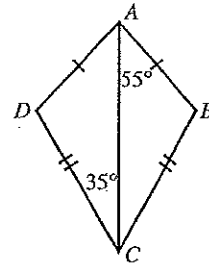
$y = 180 - 75$   
 $= 105$



31 (4 marks)  $ABCD$  is a kite.

a Which congruence test proves that  $\triangle ABC \equiv \triangle ADC$ ?

S. S. S.



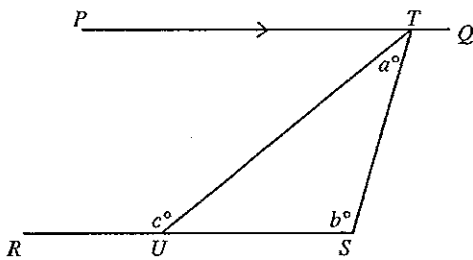
b Hence find the size of  $\angle D$ .

$\angle D = 90^\circ$

27 (2 marks) Name the most general quadrilateral to have four equal sides.

Square

28 (6 marks) In the diagram,  $PQ \parallel RS$  and  $c^\circ$  is the size of an exterior angle of  $\triangle TSU$ .



a Explain why  $\angle QTS = \angle TSU = b^\circ$ .

Alternate  $\angle$ s

b What type of angles are  $\angle QTU$  and  $\angle TUR$ ?

Alternate  $\angle$ s

c Hence prove that the exterior angle of  $\triangle TSU$  is equal to the sum of the two interior opposite angles.

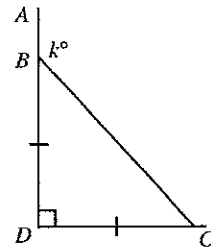
$\angle QTU = a^\circ + b^\circ$  from (a)

$\therefore \angle TUR = \angle QTU$  from (b)

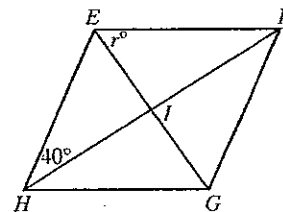
$\therefore c^\circ = a^\circ + b^\circ$  (Ext.  $\angle$  of  $\Delta$ )

32 (2 marks) Find  $k$ .

$k = 135$



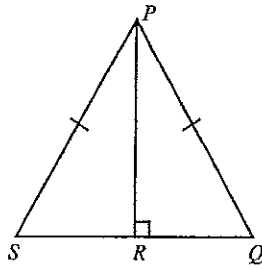
33 (2 marks) Find  $r$  if  $EFGH$  is a rhombus.



$r = 50$

**Topic test 5: Investigating geometry continued**

34 (4 marks)  $\triangle PQS$  is isosceles with  $PS = PQ$ .



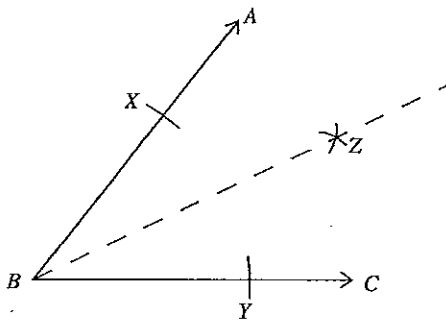
a Which congruence test can be used to prove that  $\triangle PSR \equiv \triangle PQR$ ?

*RHS*

b Hence prove that the angles opposite the equal sides in an isosceles triangle are equal.

$\angle PSR = \angle PQR$   
(Matching angles, congruency)

35 (4 marks)



$\angle ABC$  has been bisected using compasses in the following manner:

- With the compass point at  $B$ , mark points  $X$  and  $Y$ .
- With the compass point at  $X$ , and the same radius, draw an arc.
- With the compass point at  $Y$ , and the same radius, draw another arc.
- Let the two arcs intersect at  $Z$ .
- Join  $Z$  to  $B$  to bisect  $\angle ABC$ .

a What type of quadrilateral is  $BXZY$ ? Give reasons.

*rhombus*

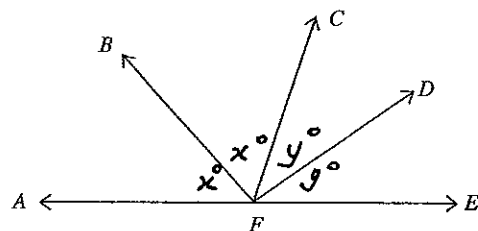
b Which property of this quadrilateral has been used to bisect  $\angle ABC$ ?

*Diagonal bisect the vertex angle of a rhombus.*

36 (2 marks) Jason, who is 1.8 metres tall, casts a shadow 2.5 metres long while a flagpole casts a shadow 11.25 metres long. How tall is the flagpole?

$$x = 15.625$$

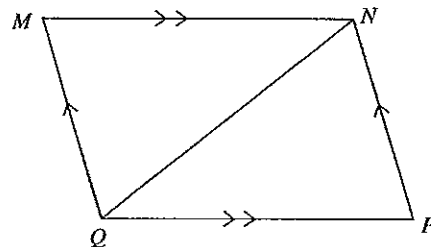
37 (3 marks) In the diagram,  $\angle AFC = 2x^\circ$  and  $\angle CFE = 2y^\circ$ .  $BF$  bisects  $\angle AFC$  and  $DF$  bisects  $\angle CFE$ . Prove that  $\angle BFD$  is a right angle.



$$2x + 2y = 180$$

$$\therefore x + y = 90$$

38 (10 marks)  $MNPQ$  is a parallelogram with  $MN \parallel QP$  and  $MQ \parallel NP$ .



a Why is  $\angle MNQ = \angle NQP$ ?

*Alternate  $\angle$ s*

b Which angle is equal to  $\angle MQN$ ?

*$\angle QNP$*

c Which congruence test can be used to prove that  $\triangle MNQ \equiv \triangle PQN$ ?

*A.A.S.*

d Hence, which angle is equal to  $\angle M$ ?

*$\angle P$*

e What property of a parallelogram does this prove?

*Opp.  $\angle$ s are equal.*

END OF TEST.