

PARALLEL AND COLLINEAR VECTORS



GRADE 8

Examination Practice Questions

You should have:

A ruler, protractor, compasses, a pen, pencil, eraser, calculator.
For some questions, you may need tracing paper.

Instructions

- Use **black** ink or ball-point pen.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used.**

Information

- The marks for each question are shown in brackets.
- Use the number of marks for each question as a guide as to how much time to spend on each question. As a rough guide, you can multiply the number of marks by 1.2 to see how many minutes you should spend on a question.
- Questions been carefully compiled from or modelled on a variety of past papers and will generally get more challenging as the document progresses. Some of the later questions may go beyond the core grade level for this topic.

Advice

- Read each question carefully before you start to answer it.
- Don't forget to have fun.
- Check your answers at the end.

Q1.

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D , E and F are three points on a straight line such that:

$$\overrightarrow{DE} = 3e + 6f$$

$$\overrightarrow{EF} = -10.5e - 21f$$

Find the ratio of length of DF : length of DE

.....
(2 marks)

Q2.

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A , B and C are three points such that:

$$\overrightarrow{AB} = 3a + 4b$$

$$\overrightarrow{AC} = 15a + 20b$$

Prove that A , B and C lie on a straight line.

.....
(2 marks)

Q3.

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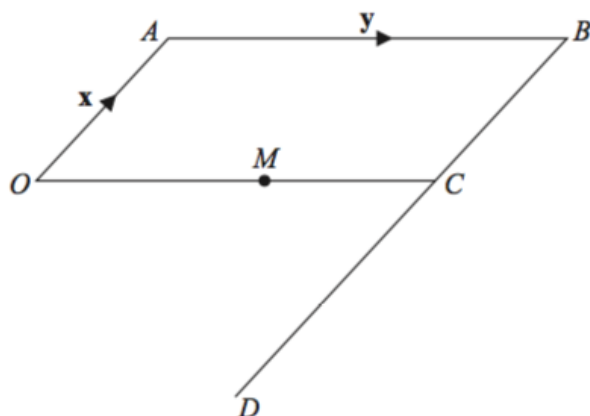


Diagram **NOT**
accurately drawn

$$\overrightarrow{AM} = \frac{1}{2}y - x \text{ and } \overrightarrow{OD} = y - 2x$$

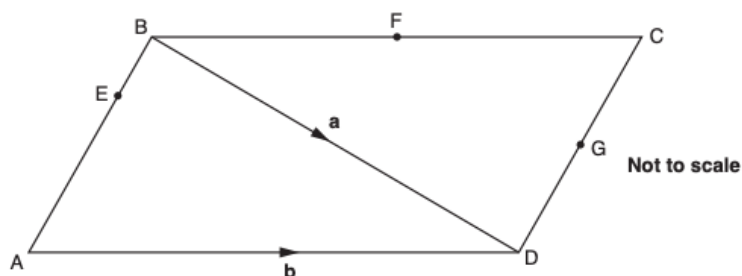
Are these two vectors parallel?

.....
(1 mark)

Q4.

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$ABCD$ is a parallelogram.



$$\overrightarrow{BD} = a \text{ and } \overrightarrow{AD} = b.$$

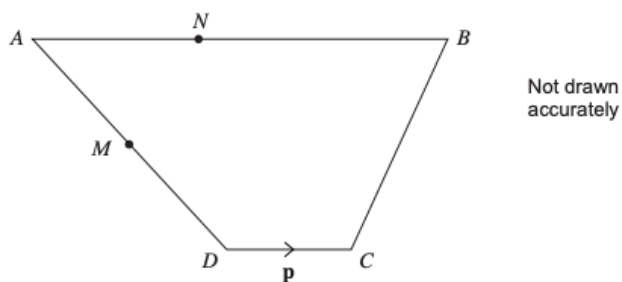
F is the midpoint of BC . G is the midpoint of DC .

$$AE = 3EB.$$

Prove that $\overrightarrow{EF}$ and $\overrightarrow{AG}$ are parallel.

(3 marks)

AB is parallel to DC .



$$\overrightarrow{AB} = 5p$$

$$\overrightarrow{DC} = p$$

$$\overrightarrow{DA} = 2q - p$$

M is the midpoint of AD .

$$\overrightarrow{AN} : \overrightarrow{NB} = 2 : 3$$

Show that MN is parallel to CB .

(3 marks)

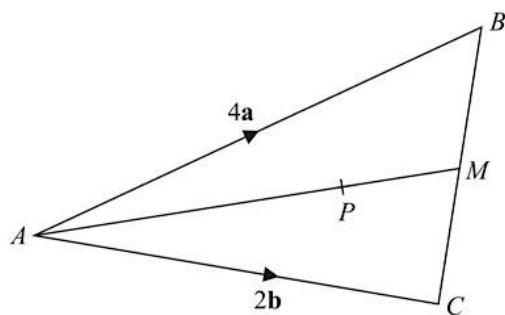


Diagram **NOT**
accurately drawn

ABC is a triangle.
The midpoint of BC is M .
 P is a point on AM .

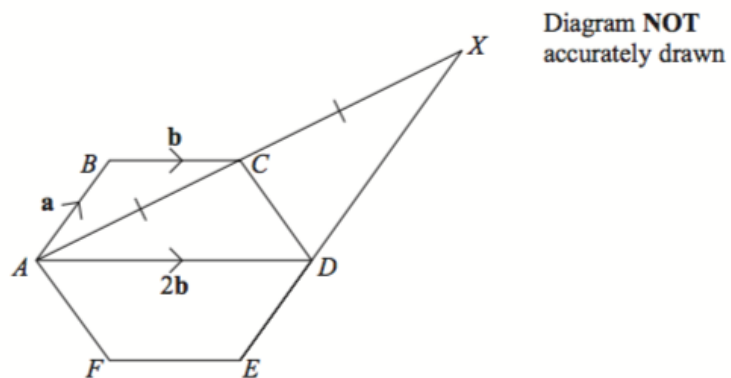
$$\overrightarrow{AB} = 4a$$

$$\overrightarrow{AC} = 2b$$

$$\overrightarrow{AP} = \frac{3}{2}a + \frac{3}{4}b$$

Show that AP is parallel to PM

(3 marks)



ABCDEF is a regular hexagon.

$$\overrightarrow{AB} = a$$

$$\overrightarrow{BC} = b$$

$$\overrightarrow{AD} = 2b$$

$$\overrightarrow{AC} = \overrightarrow{CX}$$

Prove that AB is parallel to DX .

(3 marks)

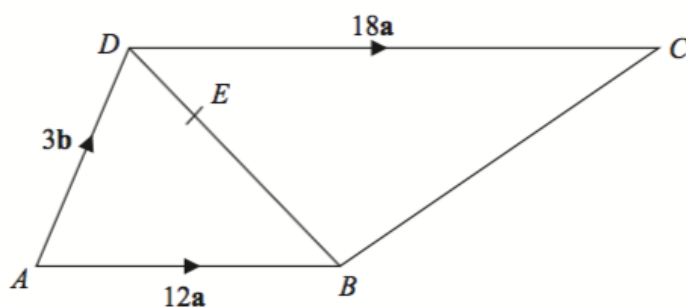


Diagram NOT
accurately drawn

$ABCD$ is a trapezium.

AB is parallel to DC .

$$\vec{AB} = 12a$$

$$\vec{AD} = 3b$$

$$\vec{DC} = 18a$$

E is the point on the diagonal DB such that $DE = \frac{1}{3}DB$.

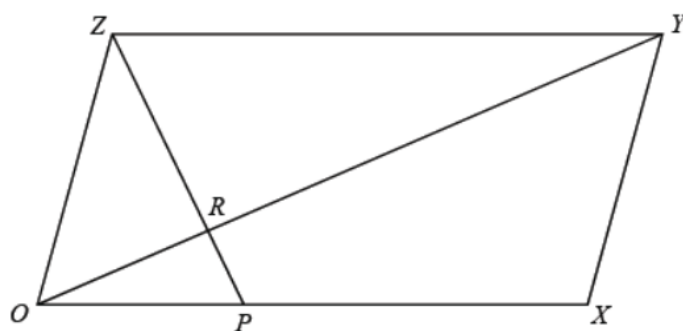
Show by a vector method that BC is parallel to AE .

(3 marks)

Given that the vector $a\begin{pmatrix} 2 \\ 6 \end{pmatrix} + b\begin{pmatrix} 8 \\ 2 \end{pmatrix}$ is parallel to the vector $\begin{pmatrix} 13 \\ 6 \end{pmatrix}$

find an expression for b in terms of a .

$OXYZ$ is a parallelogram.



$$\vec{OX} = \mathbf{a}$$

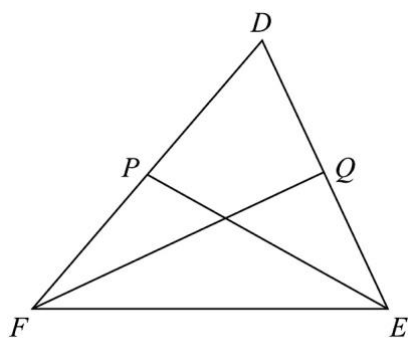
$$\vec{OY} = \mathbf{b}$$

P is the point on OX such that $OP : PX = 1 : 2$

R is the point on OY such that $OR : RY = 1 : 3$

Work out, in its simplest form, the ratio $ZP : ZR$

DEF is a triangle.



P is the midpoint of FD .

Q is the midpoint of DE .

$$\overrightarrow{FD} = a \quad \text{and} \quad \overrightarrow{FE} = b$$

Use a vector method to prove that PQ is parallel to FE .

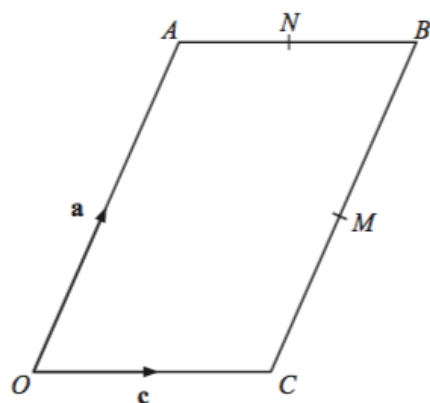


Diagram **NOT**
accurately drawn

OABC is a parallelogram.

M is the midpoint of CB.

N is the midpoint of AB.

$$\overrightarrow{OA} = a$$

$$\overrightarrow{OC} = c$$

Show that CA is parallel to MN.

The diagram shows trapezium $ABCD$.

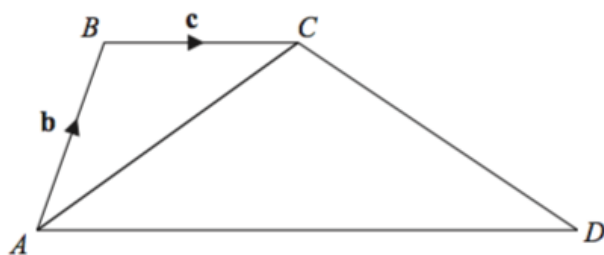


Diagram **NOT**
accurately drawn

BC is parallel to AD

$AD = 3BC$

$\vec{AB} = \mathbf{b}$, $\vec{BC} = \mathbf{c}$

It can be shown that $\vec{CD} = 2\mathbf{c} - \mathbf{b}$

The point P lies on the line AC such that $AP : PC = 2 : 1$

Is BPD a straight line?

(4 marks)

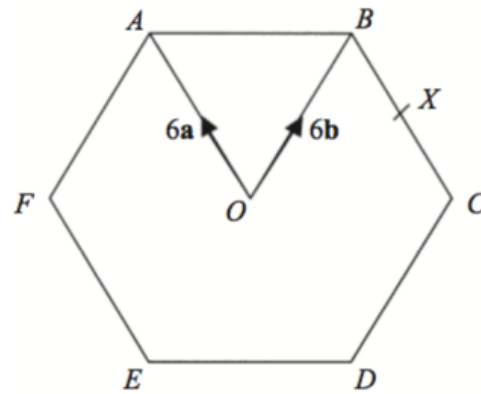


Diagram **NOT**
accurately drawn

The diagram shows a regular hexagon $ABCDEF$ with centre O .

$$\overrightarrow{OA} = 6a \quad \overrightarrow{OB} = 6b$$

X is the midpoint of BC .

Y is the point on AB extended, such that $AB:BY = 3:2$

Prove that E , X and Y lie on the same straight line.

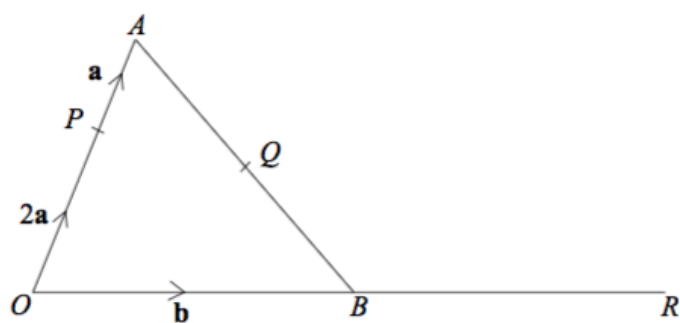


Diagram **NOT**
accurately drawn

OAB is a triangle.

B is the midpoint of OR.

Q is the midpoint of AB.

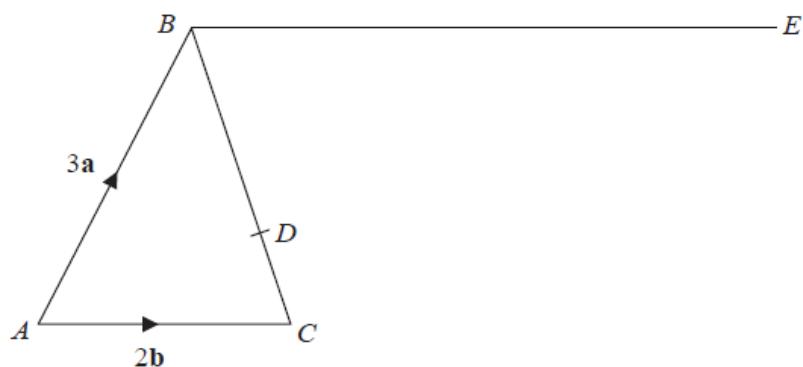
$$\overrightarrow{OP} = 2a$$

$$\overrightarrow{PA} = a$$

$$\overrightarrow{OB} = b$$

Explain why PQR is a straight line.

(3 marks)



The diagram shows triangle ABC .

$$\overrightarrow{AB} = 3\mathbf{a}$$

$$\overrightarrow{AC} = 2\mathbf{b}$$

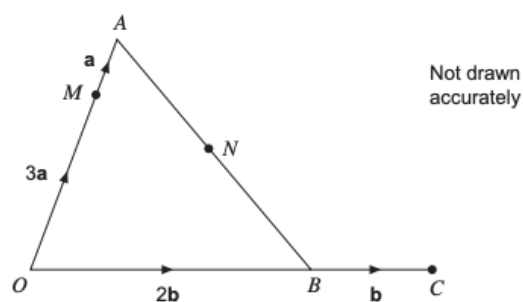
$$\overrightarrow{BE} = 3\overrightarrow{AC}$$

D is the point on BC such that $BD : DC = 3 : 1$

Prove that ADE is a straight line.

OAB is a triangle.

OBC is a straight line.



$$\overrightarrow{OA} = 4a$$

$$\overrightarrow{OB} = 2b$$

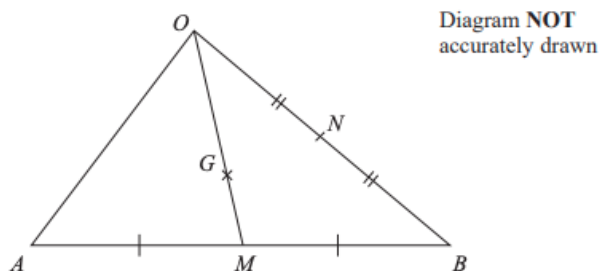
$$\overrightarrow{BC} = b$$

$$\overrightarrow{OM} = 3a$$

N is the midpoint of AB .

Show that M , N and C lie on a straight line.

(4 marks)



$$\overrightarrow{OA} = 6a \text{ and } \overrightarrow{OB} = 6b$$

M is the midpoint of AB .

N is the midpoint of OB .

G is the point on OM such that $OG:GM = 2:1$.

Show that AGN is a straight line.

OAB is a triangle.

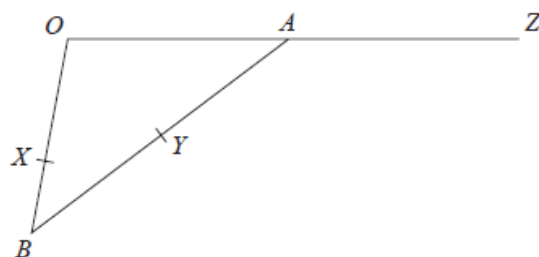
$$\overrightarrow{OA} = a \quad \overrightarrow{OB} = b$$

C is the midpoint of OA .

D is the point on AB such that $AD:DB = 3:1$

E is the point such that $\overrightarrow{OB} = 2\overrightarrow{BE}$

Using a vector method, prove that the points C , D and E lie on the same straight line.



OAB is a triangle.

A is the midpoint of OZ

Y is the midpoint of AB

X is a point on OB

$$\vec{OA} = a \quad \vec{OX} = 2b \quad \vec{XB} = b$$

Prove that XYZ is a straight line.

$ACEF$ is a parallelogram.

B is the midpoint of AC .

M is the midpoint of BE .

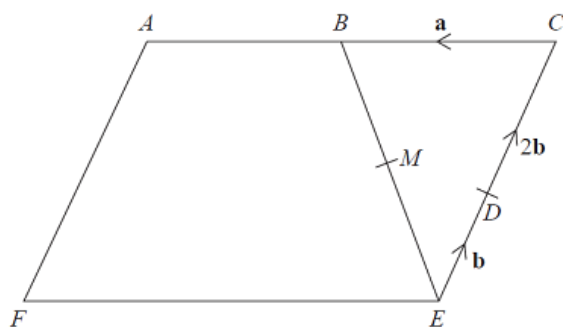
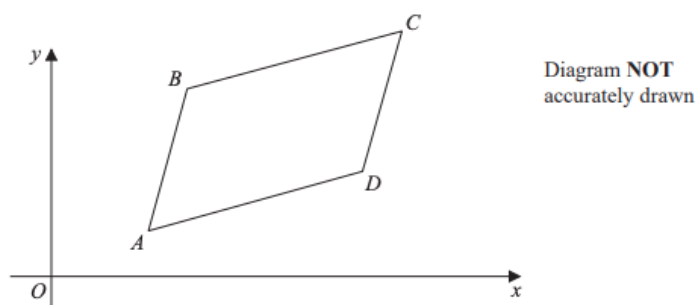


Diagram **NOT**
accurately drawn

Prove that AMD is straight line.

The diagram shows parallelogram $ABCD$.



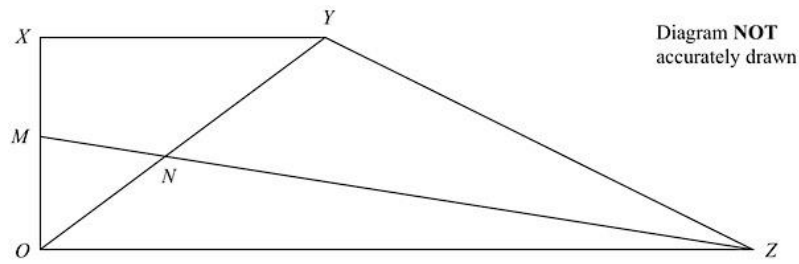
$$\overrightarrow{AB} = \begin{pmatrix} 2 \\ 7 \end{pmatrix} \quad \overrightarrow{AC} = \begin{pmatrix} 10 \\ 11 \end{pmatrix}$$

The point B has coordinates $(5,8)$

The point E has coordinates $(63,211)$

Use a vector method to prove that ABE is a straight line.

$OXYZ$ is a trapezium.



$$\overrightarrow{OX} = a$$

$$\overrightarrow{XY} = b$$

$$\overrightarrow{OZ} = 3b$$

M is the midpoint of OX

N is the point such that MNZ and ONY are straight lines.

Given that $ON:OY = \lambda:1$

Use a vector method to find the value of λ

OAB is a triangle.

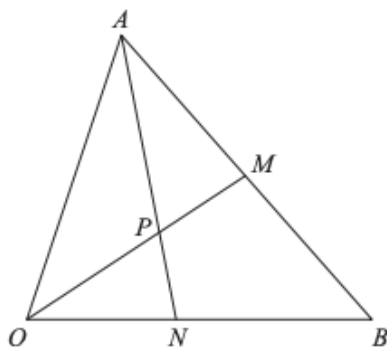
$$\overrightarrow{OA} = \mathbf{a} \quad \overrightarrow{OB} = \mathbf{b}$$

The point C lies on OA such that $OC : CA = 1 : 2$

The point D lies on OB such that $OD : DB = 1 : 2$

Using a vector method, prove that $ABCD$ is a trapezium.

(3 marks)



OAB is a triangle.

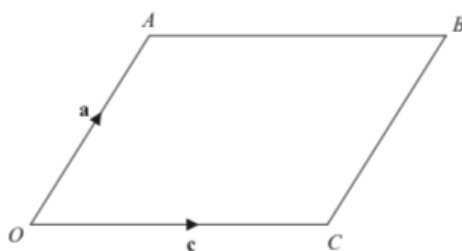
OPM and APN are straight lines.

M is the midpoint of AB .

$$\overrightarrow{OA} = a \quad \overrightarrow{OB} = b$$

$$OP:PM = 3:2$$

Prove that ONB is a straight line.



$OABC$ is a parallelogram.

$$\vec{OA} = a \text{ and } \vec{OC} = c$$

X is the midpoint of the line AC .

OCD is a straight line so that $OC:CD = k:1$

$$\text{Given that } \vec{XD} = 3c - \frac{1}{2}a$$

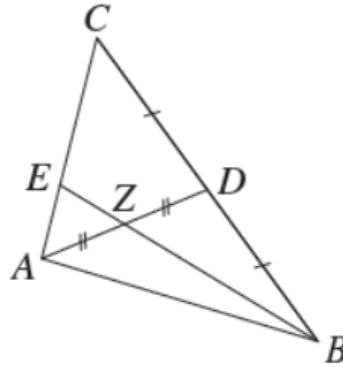
Find the value of k .

QUESTIONS FROM MATHEMATICAL COMPETITIONS

Q1.

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The diagram shows a triangle ABC and two lines AD and BE , where D is the midpoint of BC and E lies on CA . The lines AD and BE meet at Z , the midpoint of AD .



What is the ratio of the length CE to the length EA ?