Name:	School:	Target Grade:

PARADIGM

SECONDARY 4 EM WA2
MOCK EXAM PAPER

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Find a nice comfortable spot without distraction.

2. Be fully focused for the whole duration of the test.

3. Speed is KING. Finish the paper as soon as possible then return-back to Check Your Answers.

4. As you are checking your answers, always find ways to VALIDATE your answer.

5. Avoid looking through line by line as usually you will not be able to see your Blind Spot.

6. If there is no alternative method, cover your answer and REDO the question.

7. Give non-exact answers to 3 significant figures, or 1 decimal place for angles in degree, or 2 decimal place for $$$, unless a different level of accuracy is specified in the question.

Wish you guys all the best in this test.

You can do it.

I believe in you.

Team Paradigm

If you are struggling in this paper, it's an indication to work harder!
If you need support and personalised guidance, you can find us here
www.mathtutor.com.sg

PARADIGM [Turn Over]

Name: ______________________________ Class: ______ Date: _________

Secondary 4 Mathematics
Mock Paper

Topic: Vectors

Duration: 40 minutes

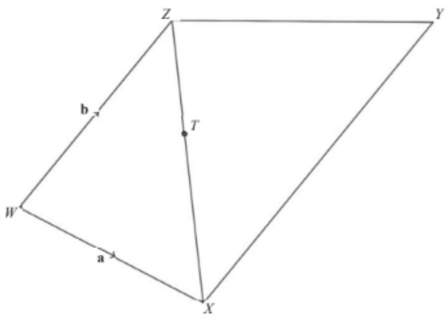
/25

Vectors

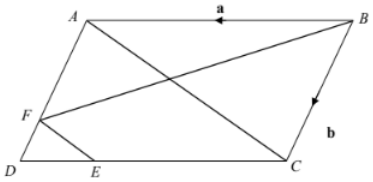
1 ABCD is a parallelogram. $\overrightarrow{AB} = \begin{pmatrix} -1 \\ -5 \end{pmatrix}$ and $\overrightarrow{BD} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$.
The coordinates of D is (6,2). Find

(a) the coordinates of B, [1]
(b) $\overrightarrow{BC}$, [1]
(c) the magnitude of $\overrightarrow{CD}$. [2]

2 In the diagram, WXYZ is a quadrilateral such that $\overline{WX} = a$, $\overline{WZ} = b$ and $\overline{WZ} = \frac{2}{3}\overline{XY}$. T is a point on XZ such that $55\overline{TX} = 3\overline{ZX}$.



(a) What is the special name given to the quadrilateral $WXYZ$? [1]
(b) Express, as simply as possible, in terms of a and b,
(i) $\overline{ZX}$, [1]
(ii) $\overline{WY}$, [1]
(iii) $\overline{WT}$. [2]
(c) Explain why points W, T and Y lie on a straight line. [2]
(d) Find
(i) $\frac{Area\ of\ triangle\ WZT}{Area\ of\ triangle\ YXT}$, [1]
(ii) $\frac{Area\ of\ triangle\ YZT}{Area\ of\ triangle\ YXT}$, [2]

3	(a) Given that $\overline{RS} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ and the position vector of R is $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$, find (i) $\lvert\overline{RS}\rvert$, (ii) the coordinates of S. (b)  ABCD is a parallelogram. $\overline{AF} = 2\overline{FD}, \overline{ED} = \frac{1}{3}\overline{CD}$, $\overline{BA} = a$ and $\overline{BC} = b$. (i) Express, as simply as possible, in terms of a and/or b, (a) $\overline{EC}$, (b) $\overline{DF}$, (c) $\overline{CA}$, (d) Are $\overline{FE}$ and $\overline{CA}$ parallel vectors? Explain your answer with working. (ii) Calculate the value of (a) $\frac{area\ of\ \Delta DEF}{area\ of\ \Delta DCA}$, (b) $\frac{area\ of\ \Delta DEF}{area\ of\ parallelogram\ ABCD}$.	 [1] [1] [1] [1] [2] [2] [1] [2]

Answer Key

1	Solutions: (a) $\overline{BO} + \overline{OD} = \overline{BD}$ $\overline{OB} = \overline{OD} - \overline{BD}$ $= \begin{pmatrix} 6 \\ 2 \end{pmatrix} - \begin{pmatrix} 4 \\ 8 \end{pmatrix}$ $= \begin{pmatrix} 2 \\ -6 \end{pmatrix}$ $\therefore B(2, -6)$ (b) $\overline{BA} + \overline{BC} = \overline{BD}$ $\overline{BC} = \overline{BD} - \overline{BA}$ $= \begin{pmatrix} 4 \\ 8 \end{pmatrix} - \begin{pmatrix} 1 \\ 5 \end{pmatrix}$ $= \begin{pmatrix} 3 \\ 3 \end{pmatrix}$ (c) $\lvert\overline{CD}\rvert = \lvert\overline{AB}\rvert$ $= \sqrt{(-1)^2 + (-5)^2}$ $= \sqrt{26}$ $= 5.09902$ $= 5.10$ Ans: $(a)(2, -6)$ (b) $\begin{pmatrix} 3 \\ 3 \end{pmatrix}$ (c) 5.10	
2	Solutions: (b)(i) $\overrightarrow{ZX} = \overrightarrow{ZW} + \overrightarrow{WX} = -\mathbf{b} + \mathbf{a}$ **OR** $\overrightarrow{ZX} = \overrightarrow{WX} + \overrightarrow{WZ} = \mathbf{a} - \mathbf{b}$ (ii) $\overrightarrow{WY} = \overrightarrow{WX} + \overrightarrow{XY} = \mathbf{a} + \frac{3}{2}\mathbf{b}$ (iii) $5\overrightarrow{TX} = 3\overrightarrow{ZX}$ $\overrightarrow{TX} = \frac{3}{5}\overrightarrow{ZX}$ $\overrightarrow{ZT} = \frac{2}{5}\overrightarrow{ZX}$ $\overrightarrow{WT} = \overrightarrow{WZ} + \overrightarrow{ZT} = \overrightarrow{WZ} + \frac{2}{5}\overrightarrow{ZX} = \mathbf{b} + \frac{2}{5}(\mathbf{a} \quad \mathbf{b})$ $\overrightarrow{WT} = \frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}$ or $(2\mathbf{a} + 3\mathbf{b})$ or $\frac{2}{5}(\mathrm{a} + \frac{3}{2}\mathbf{b})$ **OR** $\overrightarrow{WT} = \overrightarrow{WX} + \overrightarrow{XT}$ $\overrightarrow{WT} = \overrightarrow{WX} + \frac{3}{5}(\overrightarrow{ZX})$ $\overrightarrow{WT} = \frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}$ **OR** $\frac{1}{5}(2\mathbf{a} + 3\mathbf{b})$ **OR** $\frac{2}{5}(\mathbf{a} + \frac{3}{2}\mathbf{b})$	

	(c) $\overrightarrow{WY} = \mathbf{a} - \frac{3}{2}\mathbf{b} = \frac{1}{2}(2\mathbf{a} + 3\mathbf{b})$ $\overrightarrow{WT} = \frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b} = \frac{1}{5}(2\mathbf{a} + 2\mathbf{b})$ $\frac{WT}{WY} = \frac{(1/5)}{(1/2)} = \frac{2}{5}$ $\overrightarrow{WT} = \frac{2}{5}\overrightarrow{WY}$ $\overrightarrow{WT}$ and $\overrightarrow{WY}$ are parallel. W is a common point. Hence W, T and Y lie on a straight line Answer: (a) Trapezium (bi) $\overrightarrow{ZX} = \overrightarrow{WX} - \overrightarrow{WZ} = a - b$ (bii) $a + \frac{3}{2}b$ (biii) $\frac{2}{5}(a + \frac{3}{2}b)$ (c) $\overrightarrow{WT}$ *and* $\overrightarrow{WY}$ are parallel. W is a common point. Hence W, T and Y lie on a straight line. (di) $\frac{\text{Area of triangle WZT}}{\text{Area of triangle YXT}} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$ (dii) $\frac{\text{Area of triangle YZT}}{\text{Area of triangle YXT}} = \frac{\left(\frac{1}{2} x\ ZT\ x\ h\right)}{\left(\frac{1}{2} x\ XT\ x\ h\right)} = \frac{2}{3}$	
3	Solutions: (a)(i) $\lvert\overrightarrow{RS}\rvert$, $\lvert\overrightarrow{RS}\rvert = \sqrt{(-1)^2 + 2^2} = 2.24$ units (3s.f.) (ii) the coordinates of S. $\overrightarrow{OS} = \overrightarrow{OR} + \overrightarrow{RS}$ $\overrightarrow{OS} = \begin{pmatrix} 3 \\ -5 \end{pmatrix} + \begin{pmatrix} -1 \\ 2 \end{pmatrix}$ $\overrightarrow{OS} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$ Hence coordinates of S is (2,3). (b)(i)(c) $\overline{CA} = \overline{CD} + \overline{DA}$ $\overline{CA} = \mathbf{a} - \mathbf{b}$ (i)(d) $\overline{FE} = \overline{ED} + \overline{DE}$ $\overline{FE} = \frac{1}{3}\mathbf{b} - \frac{1}{3}\mathbf{a}$ $\overline{FE} = \frac{1}{3}(\mathbf{a} - \mathbf{b})$ $\overline{FE} = \frac{1}{3}\overline{CA}$ Hence, they are parallel vectors Ans: (a)(i) 2.24 units (ii) Hence coordinate of S is (2,-3) (b)(i-a) $\overline{EC} = -\frac{2}{3}a$ (b)(i-b) $\overline{DF} = -\frac{1}{3}b$ (b)(i-c) $\overline{CA} = a - b$ (b)(i-d) $\overline{FE} = -\frac{1}{3}\ CA$ Hence, they are parallel vectors. (b)(ii-a) $\frac{\text{Area of }\Delta\text{DEF}}{\text{Area of }\Delta\text{DCA}} = \left(\frac{1}{3}\right)^2 = \frac{1}{9}$ (b)(ii-b) $\frac{\text{Area of }\Delta\text{DEF}}{\text{Area of ABCD}} = \frac{1}{9x2} = \frac{1}{18}$	