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Grade 12

Core Mathematics: Paper II

September 2020

Time: 3 hours

Marks: 150

Please read the following instructions carefully:

1. This question paper consists of 23 pages and an Information sheet. Please check that your question paper is complete.
2. **Answer all the questions on the question paper.**
3. You may use an approved non-programmable and non-graphical calculator.
4. All necessary working details must be clearly shown.
5. Round off answers to **1 decimal place** where necessary, unless otherwise stated.
6. Ensure that your calculator is in **DEGREE** mode.
7. Diagrams may not be drawn to scale.
8. **A mark is not necessarily allocated to the correct answer** but rather the working. Show all working.

	SECTION A						SECTION B							
	Analytical Geometry	Statistics	Statistics	Statistics	Euclidean Geometry	Trigonometry	Analytical Geometry	Analytical Geometry	Trigonometry	Trigonometry	Trigonometry	Euclidean Geometry	Euclidean Geometry	Euclidean Geometry
Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mark														
Total	14	11	6	6	17	22	11	8	7	8	11	6	11	12
Total														
													150	
													Percentage	
													100	

IEB exam number: _____

Name: _____

Teacher: _____

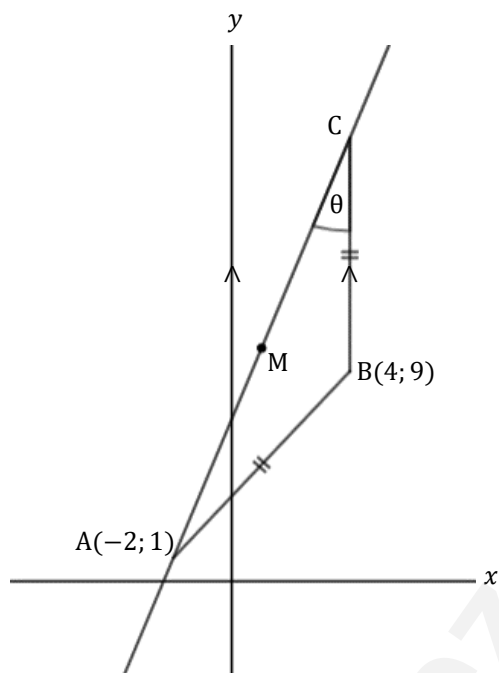
SECTION A

Question 1

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In the diagram below, ABC is an isosceles triangle with $A(-2; 1)$ and $B(4; 9)$.

$AB = BC$ and BC is parallel to the y-axis.



(a) Calculate the length of AB.

(2)

(b) Give the equation of the line BC.

(1)

(c) Give the coordinates of C.

(2)

(d) Calculate the coordinates of M, the midpoint of AC.

(2)

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(e) Determine the equation of AC in the form $y = mx + c$.

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(3)

(f) Calculate the size of θ .

(4)

[14]

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Question 2

(a) Unordered data is shown below:

x	21	38	x	20	41	25	x	46	13
-----	----	----	-----	----	----	----	-----	----	----

The value of x occurs three times and is the same unknown value. Determine the value of x if the mean of this data is 30.

(b) The data listed below shows the distance (in kms) travelled by cyclists each day of a fifteen day tour.

85	125	140	135	115
132	105	126	108	135
112	119	128	93	127

(i) Use your calculator to determine the:

1. mean distance travelled

2. standard deviation.

(ii) On how many days do the cyclists travel a distance that is within 1 standard deviation of the mean? Show all working.

(iii) The median distance travelled is 125km. Determine the skewness of the data and show working.

(iv) Before the start of each leg of the 15 day tour, the cyclists had an additional warm-up ride of x km. Write down, in terms of x (where applicable), the actual:

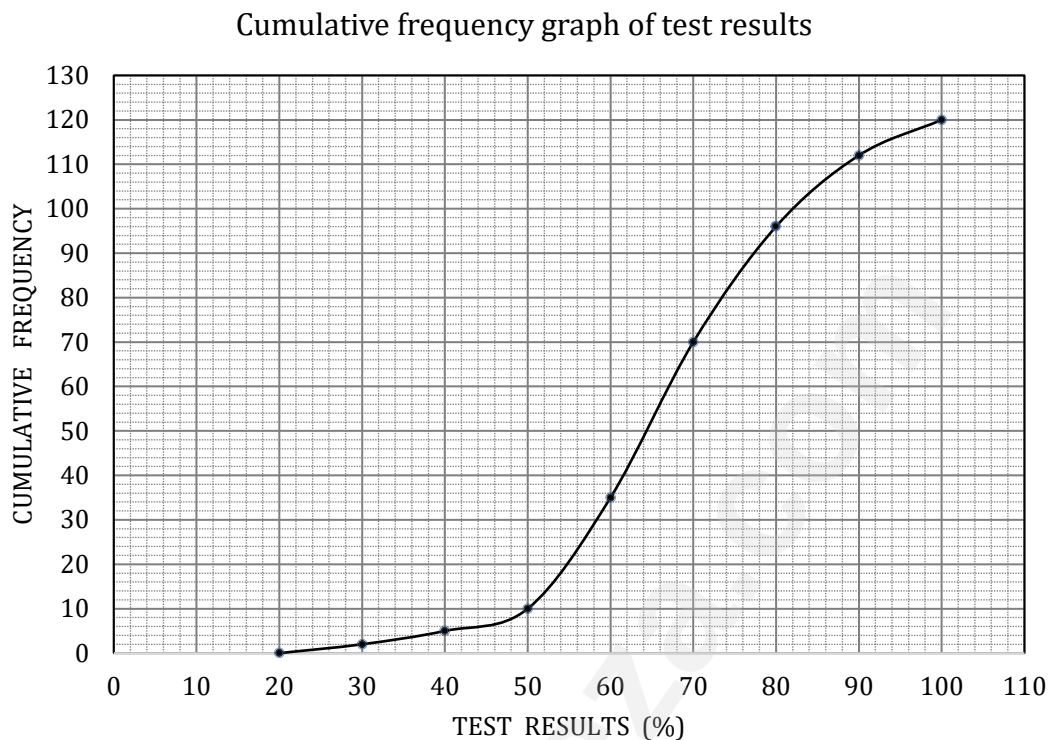
1. mean

2. standard deviation.

Question 3

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A group of learners wrote a test and the percentages they scored are shown in the cumulative frequency graph below.



(a) How many learners wrote the test?

_____ (1)

(b) How many learners scored at least 80% for the test?

_____ (2)

(c) Use the graph to calculate the inter-quartile range.

_____ (3)

[6]

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Question 4

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A student tested positive for Corona Virus and her temperature was taken every hour between 12h00 and 18h00. Her temperature was recorded in the table below:

Time	12h00	13h00	14h00	15h00	16h00	17h00	18h00
Temperature (°C)	37,0°	38,6°	39,4°	39,3°	38°	37,6°	37,5°

Answer the following question to **4 decimal places**:

- (a) Give the correlation coefficient and describe the correlation of the data

(2)

- (b) Determine the equation of the line of best fit in the form $y = a + bx$.

(2)

- (c) Use the line of best fit to estimate the student's temperature at 15h30.

(2)

[6]

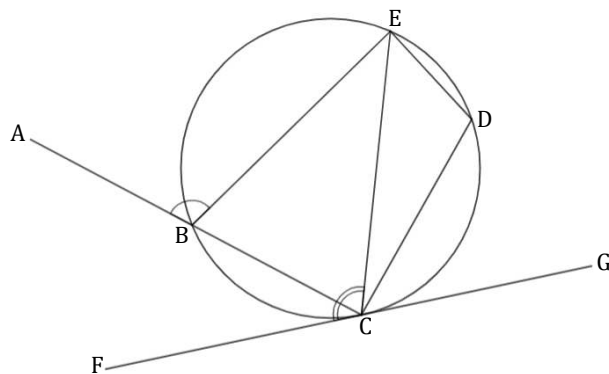
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Question 5

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Give full reasoning for the following questions.

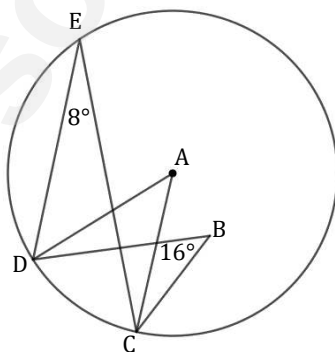
- (a) In the diagram below, FG is a tangent to the circle at C. Chord CB is extended to A and the quadrilateral BCDE is cyclic.



Prove that $\widehat{ABE} = \widehat{FCE}$.

(2)

- (b) In the given diagram, A is the centre of the circle. E, D and C are on the circumference. Show that ABCD is a cyclic quadrilateral.

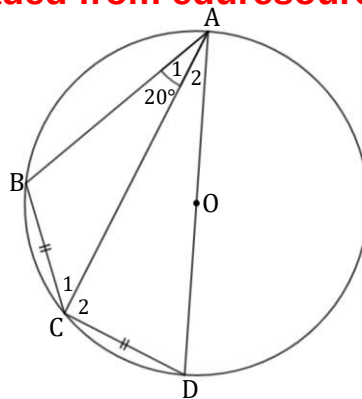


(3)

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(c) In the diagram, AOD is a diameter of the circle centred at O. $BC = CD$ and $\hat{A}_1 = 20^\circ$

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Determine the size of each of the following angles:

(i) $\hat{A}_2$

_____ (1)

(ii) $\hat{C}_2$

_____ (1)

(iii) $\hat{ABC}$

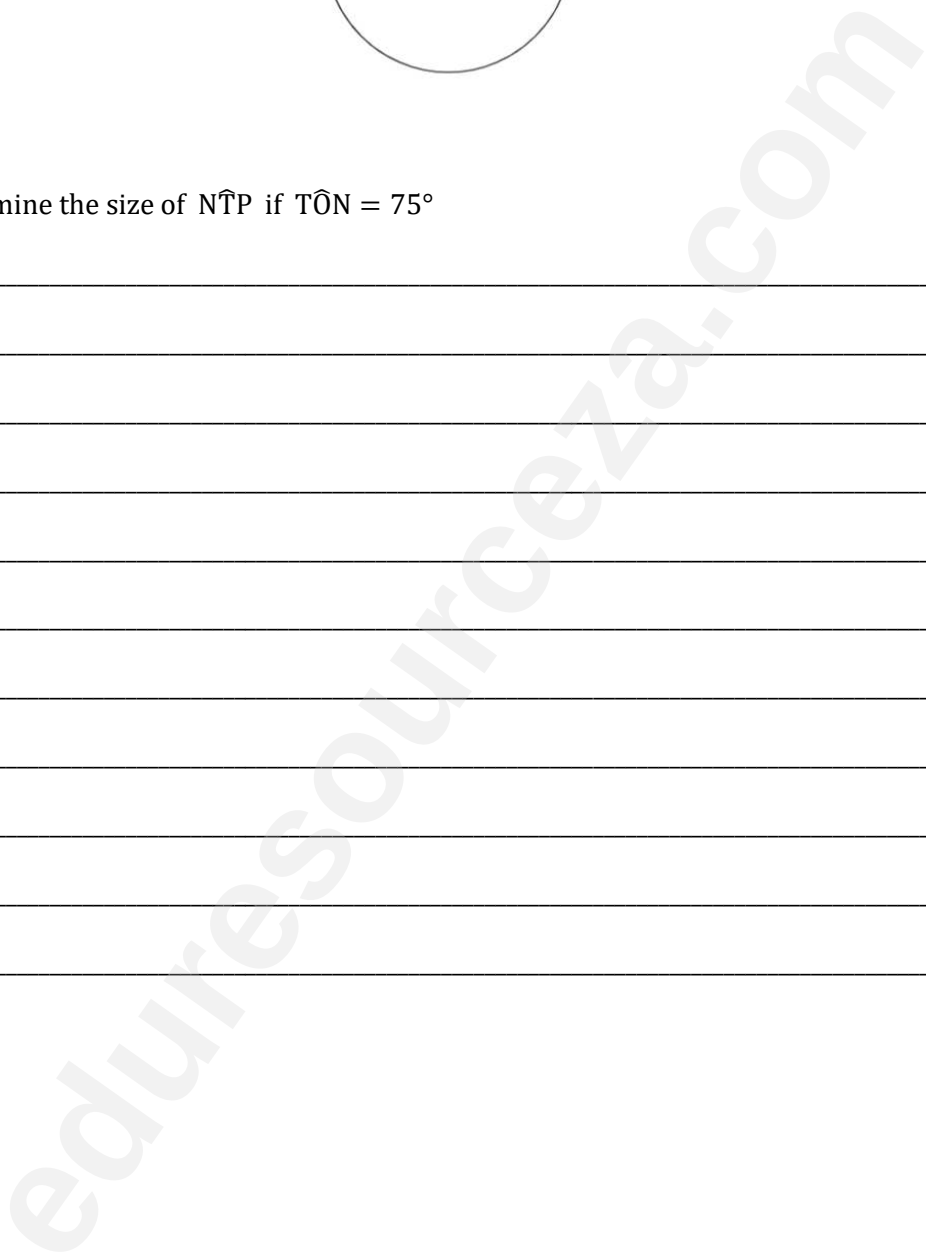
 _____ (2)

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(2)



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(6)

[17]

Question 6

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(a) If $\cos 23^\circ = \frac{1}{\sqrt{1+m^2}}$, determine the following in terms of m :

(i) $\tan 23^\circ$

(3)

(ii) $\cos 46^\circ$

(3)

(b) Simplify the expression: $\frac{\sin(450^\circ - x) \cdot \tan(x - 180^\circ) \cdot 2 \sin 35^\circ \cdot \cos 35^\circ}{\cos(-20^\circ) \cdot \sin(-x)}$

(8)

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(c) Evaluate the expression $\cos 105^\circ$ without the use of a calculator and showing all working:

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(4)

(d) Prove the identity $\frac{\sin^2 x + 3 \cos^2 x - 2}{\cos^2 x - \sin^2 x} = 1$

(4)

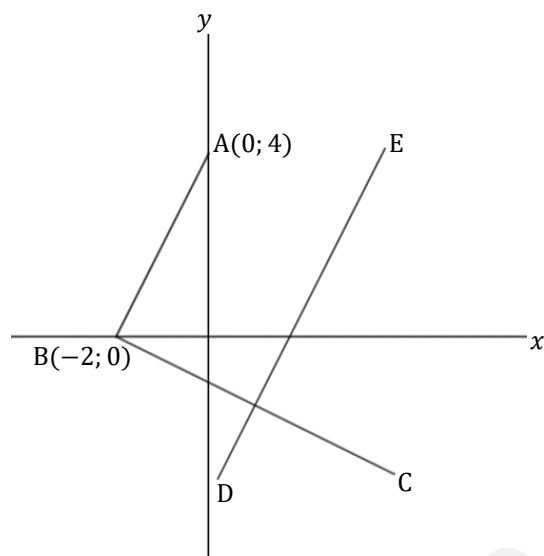
[22]

Total of section A [76]

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Question 7

DE is the diameter of the circle and the equation of the line DE is $y = 2x - \frac{7}{2}$.



- (a) Determine the coordinates of the centre of the circle that passes through A, B and C.

[illegible]

(b) Calculate the coordinates of C if the centre of the circle is $(2; \frac{1}{2})$ and if AC is a diameter.

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(3)

[11]

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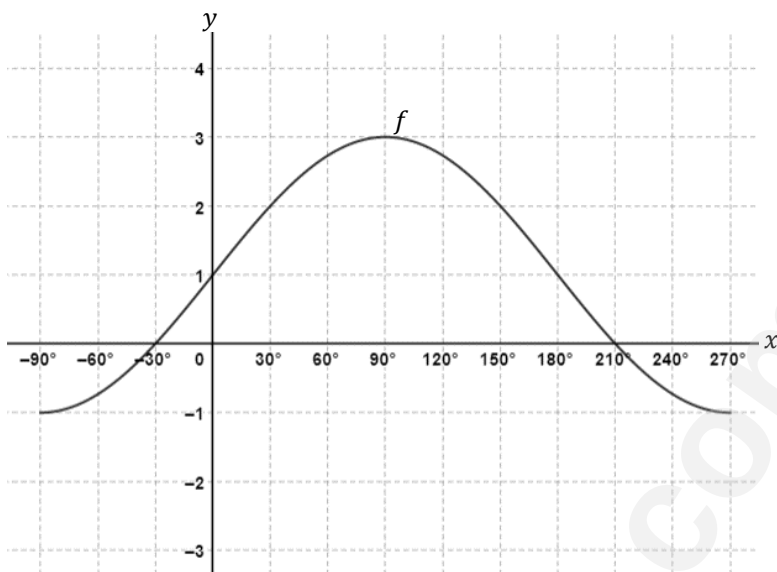
Circle B: $x^2 + y^2 - 10x + 2y + 17 = 0$

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Question 9

The graph of $f(x) = 2 \sin x + 1$ is sketched below with $x \in [-90^\circ; 270^\circ]$



- (a) For what values of k will $f(x) = k$ have no real solutions?

(2)

- (b) On the same set of axes shown above, sketch the graph of $g(x) = 2 \cos(x - 30^\circ)$ with $x \in [-90^\circ; 270^\circ]$
Show clearly the coordinates of the endpoints and the y -intercept.

Working space:

(4)

- (c) For what values of x is $f(x) \geq g(x)$ if $x \in [-90^\circ; 270^\circ]$

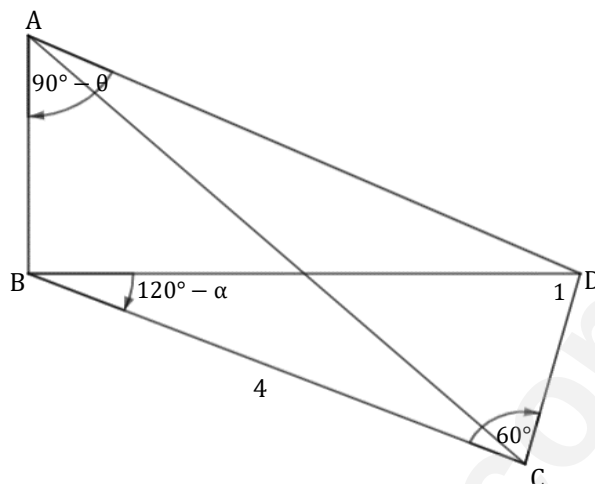
(1)
[7]

Question 10

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In the diagram below, B, C and D are in the same horizontal plane. A drone positioned at A, captures the images of two objects at B and C. B is directly below the drone and C is 4 units away from B.

$AB \perp BD$; $\widehat{DCB} = 60^\circ$; $\widehat{DBC} = 120^\circ - \alpha$; $\widehat{BAD} = 90^\circ - \theta$



- (a) Determine $\widehat{D}_1$ in terms of α

(2)

- (b) Determine BD in terms of α and without the use of a calculator.

(3)

- (c) Show that $AB = \frac{2\sqrt{3} \tan \theta}{\sin \alpha}$

(3)

[8]

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Question 11

(a) Solve for x if: $\sin^2 x - \sin x = 0$

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(3)

Question 11

(a) Solve for x if: $\sin^2 x - \sin x = 0$

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(4)

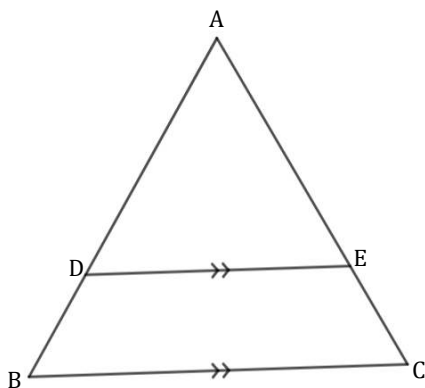
(c) Solve for a and b if: $\cos(a + b) = \frac{\sqrt{2}}{2}$ where $(a + b) \in [0^\circ; 180^\circ]$
 $\cos(a - 2b) = \frac{1}{2}$ where $(a - 2b) \in [0^\circ; 180^\circ]$

(4)
[11]

Question 12

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Use the given diagram to prove that a line drawn parallel to one side of a triangle divides the other two sides in proportion. Hence, for the given diagram, if $DE \parallel BC$, then $\frac{AD}{DB} = \frac{AE}{EC}$.



Given: $DE \parallel BC$

R.T.P: $\frac{AD}{DB} = \frac{AE}{EC}$

[6]

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Question 13

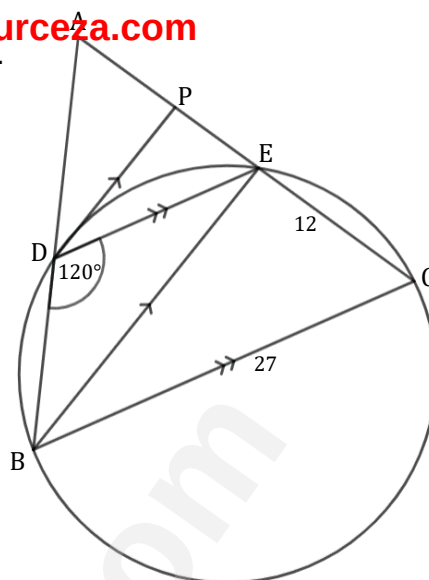
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In $\triangle ABC$ in the diagram, D is a point on AB such that $AD:DB = 5:4$.

P and E are points on AC such that $DE \parallel BC$ and $DP \parallel BE$

BC is not a diameter of the circle.

$\widehat{BDE} = 120^\circ$, $EC = 12$ units and $BC = 27$ units



Determine, with reasons:

(a) the length of AE

(3)

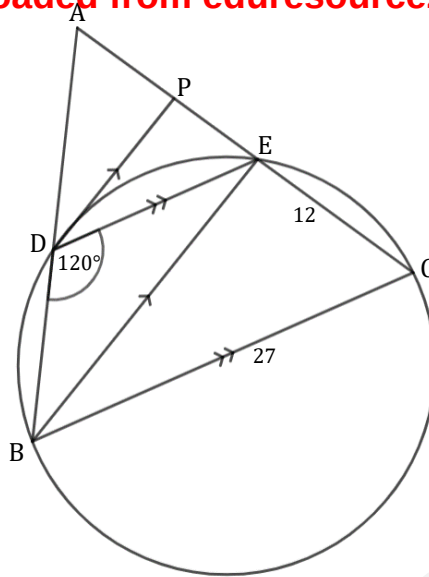
(b) $\frac{\text{area of } \triangle AEB}{\text{area of } \triangle ECB}$

(2)

(c) the length of BE (leave your answer in surd form)

(3)

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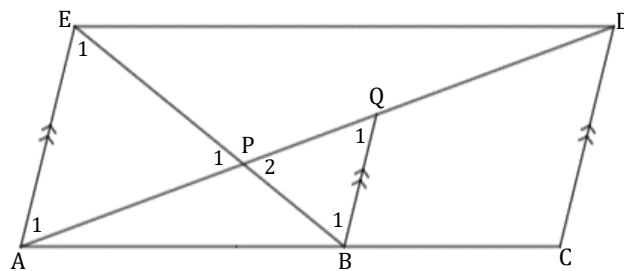


(d) Hence, determine the length of DP if $\triangle ADP \sim \triangle ABE$.

(3)
[11]

Question 14

In the diagram below, ACDE is a parallelogram and $AE \parallel BQ \parallel CD$. $AB:BC = 3:2$



- (a) Write down $\frac{AQ}{QD}$

(2)

- (b) Show that $\frac{QP}{AP} = \frac{QB}{EA}$

(3)

- (c) Hence show that $\frac{QP}{AP} = \frac{QB}{DC}$

(1)

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[12]

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