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YISHUN TOWN SECONDARY SCHOOL



PRELIMINARY EXAMINATION 2024 SECONDARY 4 EXPRESS MATHEMATICS PAPER 1 (4052/01)

DATE : 16 August 2024
DURATION : 2 h 15 min

DAY : Friday
MARKS : 90

READ THESE INSTRUCTIONS FIRST

Do not turn over the cover page until you are told to do so.
Write your name, class and class index number in the spaces at the top of this page.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

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 90.

	MARKS	
	OBTAINED	FULL
1		1
2		2
3		2
4		2
5		2
6		2
7		2
8		3
9		4
10		4
11		4
12		4
13		4
14		4
15		4
16		4
17		4
18		4
19		4
20		4
21		4
22		5
23		5
24		5
25		7
TOTAL		90

This question paper consists of **25** printed pages and **1** blank page.

Mathematical Formulae*Compound interest*

$$\text{Total amount} = P \left(1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

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

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

Answer **all** the questions.

- 1 Calculate $\frac{390.1}{\sqrt[3]{32.02 + 0.731}}$, giving your answer correct to 2 significant figures.

Answer [1]

- 2 The sine of an angle is 0.6310.

Give two possible values for the angle in radians.

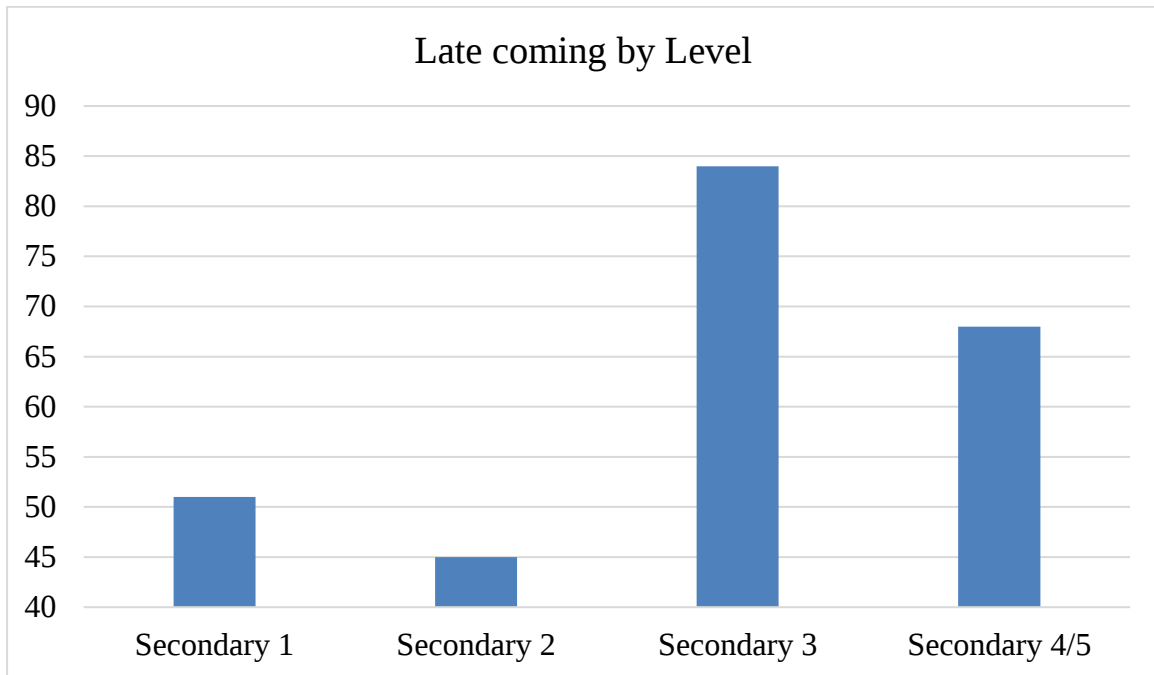
Answer or rad [2]

- 3 The cost of a meal at a restaurant is \$20.60 before service charge and Goods and Services Tax (GST).

Find the total cost of the meal inclusive of a 10% service charge and 9% GST.

Answer \$ [2]

- 4 The graph shows the number of students who were late for school in Term 1.



State one aspect of the graph that may be misleading and explain how this may lead to a misinterpretation of the graph.

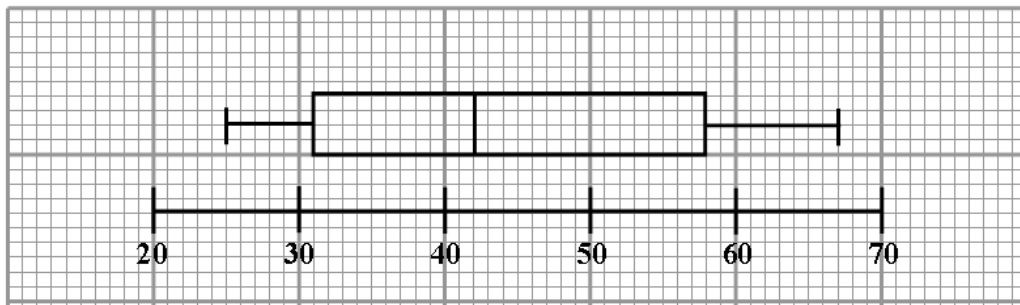
Answer

.....

.....

..... [2]

- 5 The Mathematics scores of 380 students are represented in the box-and-whisker-plot.



Find

- (a) the median score,

Answer [1]

- (b) the interquartile range of the scores.

Answer [1]

- 6 (a) Express $x^2 - 3x + 6$ in the form $(x + a)^2 + b$.

Answer [1]

- (b) Hence explain why $x^2 - 3x + 6 = 0$ has no real solution.

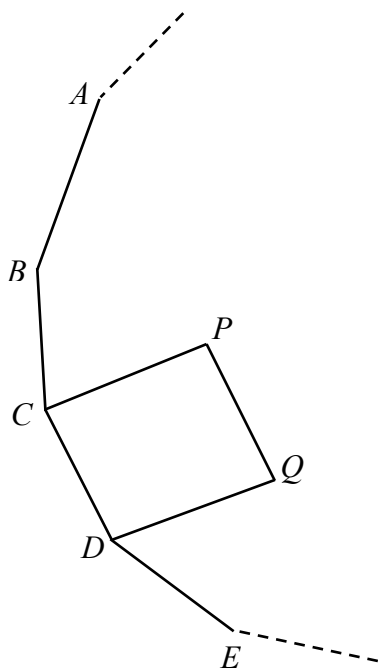
Answer
 [1]

- 7 At a carnival, the ratio of adults to children is 5 : 18.
The ratio of girls to boys is 7 : 2.

Given that the ratio of women to girls is 1 : 7, find the ratio of men to boys.

Answer : [2]

- 8 $ABCDE$ is part of a regular n -sided polygon with an interior angle of 156° .
 $CPQD$ is a rhombus such that angle $PCD = 80^\circ$.



Find

- (a) angle QDE ,

Answer [1]

- (b) the number of sides of the polygon.

Answer [2]

- 9** A microchip is made up of transistors printed on one side.
Each transistor is a flat square of side 51 nanometres.

(a) Express 51 nanometres in metres, in standard form. (1 nanometre = 10^{-9} metres)

Answer m [1]

(b) Find the surface area of each transistor in square metres, in standard form.

Answer m^2 [1]

(c) The microchip is in the shape of a square of length 0.102 cm.

Assuming that the surface of the microchip is completely filled with transistors, calculate the total number of transistors on the microchip, leaving your answer in standard form.

Answer [2]

- 10 (a) Solve the inequality $4 - 5x > \frac{4x+1}{2}$.

Answer [2]

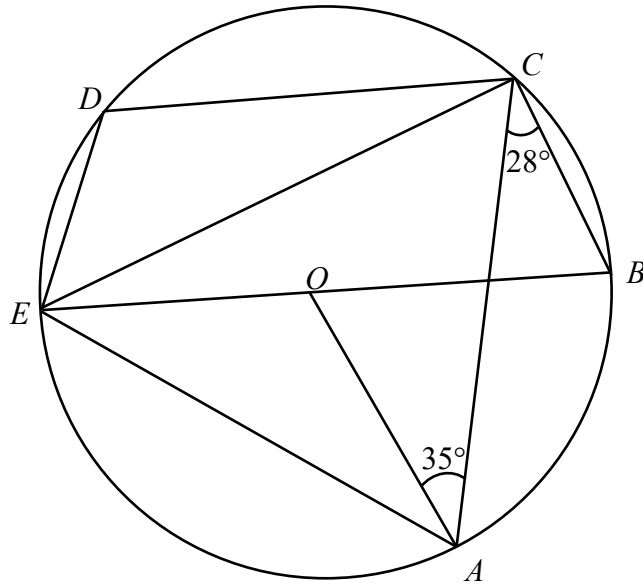
- (b) Represent your solution in (a) on a number line.

[1]

- (c) Write down the largest integer, x , which satisfies the inequality $4 - 5x > \frac{4x+1}{2}$.

Answer $x =$ [1]

- 11** In the diagram, A, B, C, D and E are points on the circle with centre O .
 Angle $OAC = 35^\circ$ and angle $ACB = 28^\circ$.
 EOB is a diameter of the circle.



Find, giving a reason for each statement you make,

- (a)** angle ECA ,

Answer [1]

- (b)** angle EOA ,

Answer [1]

- (c)** angle EDC .

Answer [2]

12 Solve $\frac{6}{1-x} - \frac{3}{x+2} = 2$.

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [4]

- 13 The first four terms in a sequence of numbers are given below.

$$T_1 = a + 4 = 5$$

$$T_2 = b + 4 = 8$$

$$T_3 = c + 4 = 13$$

$$T_4 = d + 4 = 20$$

- (a) Write down an expression, in terms of n , for the n th term of the sequence.

Answer [1]

- (b) Find and simplify an expression, in terms of n , for $T_{n+1} - T_n$.

Answer [2]

- (c) Hence explain why the difference between any two consecutive terms in the sequence is always an odd number.

Answer
 [1]

- 14** Singapore has an approximate area of 729 km^2 .
It is represented by an area of 116.64 cm^2 on Map *A*.

(a) Find the scale of the map in the form $1 : n$.

Answer : [2]

- (b)** Map *B* has a scale of $1 : 400\,000$.
A road is measured 4.2 cm on Map *A*.

Find, in centimeters, the length representing this road on Map *B*.

Answer cm [2]

- 15 (a) It takes 20 workers to renovate an apartment in 21 days.

Find the number of extra workers needed to renovate the same apartment in 14 days if they work at the same rate.

Answer [2]

- (b) y is directly proportional to the square of x .

Calculate the percentage increase in y when x is increased by 20%.

Answer % [2]

16 $\mathcal{E} = \{\text{integers } x: 0 < x \leq 10\}$

$P = \{\text{prime numbers}\}$

$Q = \{\text{factors of } 10\}$

(a) (i) Draw a Venn diagram to illustrate this information.



[1]

(ii) Hence shade the region which represents $P \cap Q$.

[1]

(b) List the elements in $P' \cup Q$.

Answer [1]

(c) Find $n(P \cap Q)'$.

Answer [1]

17 Written as a product of its prime factors $99 = 3^2 \times 11$.

(a) Express 126 as the product of its prime factors.

Answer [1]

(b) Find the lowest common multiple (LCM) of 99 and 126 as a product of its prime factors.

Answer [1]

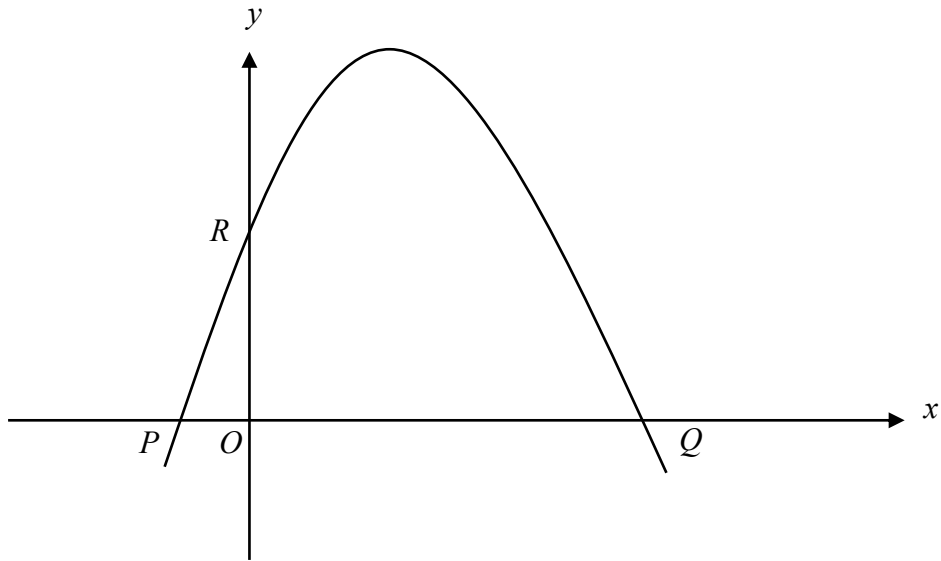
(c) Find the smallest possible perfect square that is divisible by 99 and 126.

Answer [1]

(d) Find the maximum number of students such that 99 erasers and 126 pencils can be distributed equally among them.

Answer [1]

- 18 The diagram shows the sketch of the graph $y = -x^2 + 4x + 5$.



Find

- (a) the coordinates of P , Q and R ,

Answer P (..... ,)

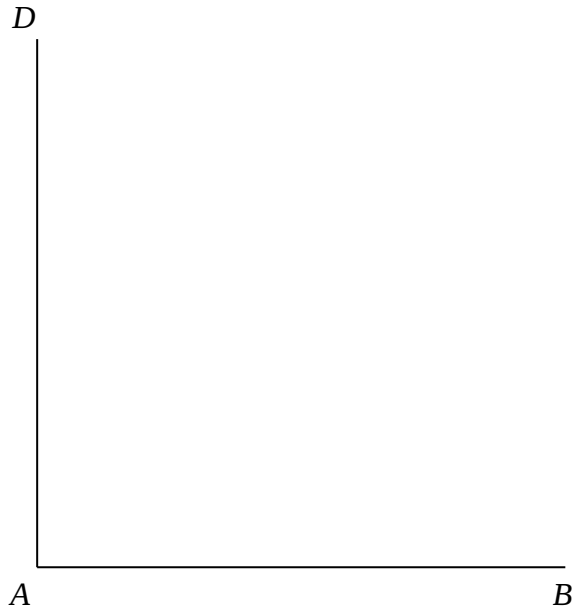
Q (..... ,)

R (..... ,) [3]

- (b) the coordinates of the turning point.

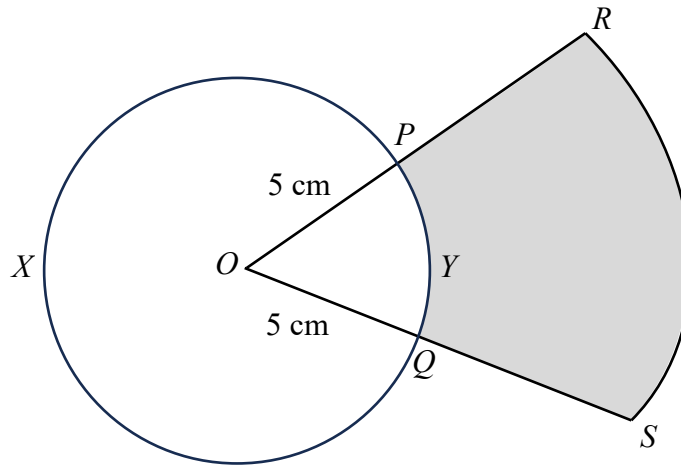
Answer (..... ,) [1]

- 19** $ABCD$ is a quadrilateral with $AB = BC$ and $CD = 4$ cm.
 AB and AD are drawn below.



- (a)** Construct quadrilateral $ABCD$. [1]
- (b)** Construct
- (i)** the bisector of angle DAB , [1]
- (ii)** the perpendicular bisector of AB . [1]
- (c)** A point M lies inside quadrilateral $ABCD$ such that $AM = BM$ and it is equidistance from AB and AD .
 Mark and label point M . [1]

- 20** The diagram shows a circle PXQ with centre O and radius 5 cm. The radii OP and OQ are produced to R and S respectively. An arc of a circle, centre O , radius 11 cm is drawn from R to S .



The area of the sector ORS is $\frac{4}{5}$ of the area of the circle PXQ .

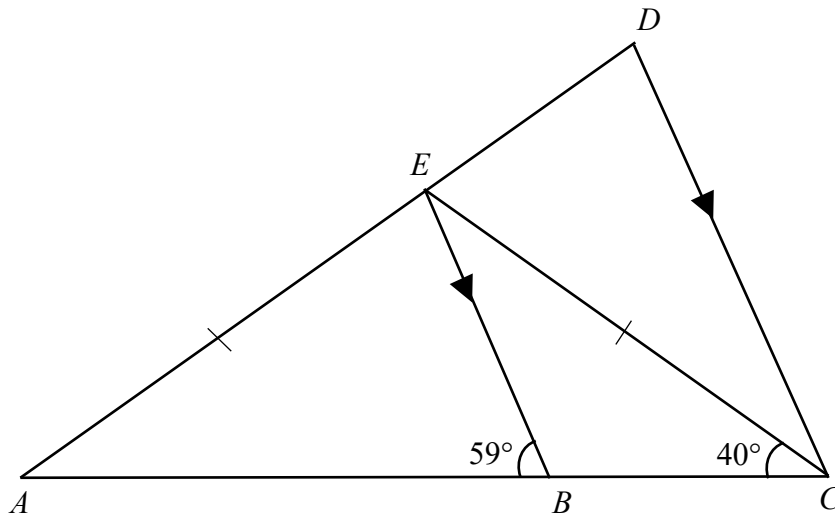
- (a)** Show that angle $POQ = 1.039$ radian, correct to 4 significant figures.

[1]

- (b)** Find the perimeter of the shaded region.

Answer cm [3]

- 21 In the diagram, which is not drawn accurately, AED and ABC are straight lines. $AE = EC$ and BE is parallel to CD .



- (a) Calculate, showing your working clearly,

(i) angle ECD ,

Answer [1]

(ii) angle EDC .

Answer [1]

- (b) Which is the longest side of the triangle ECD ?
Give a reason for your answer.

Answer
.....
..... [2]

- 22** A central kitchen makes tarts to be delivered to different bakeries 7 days a week.
The matrix, **P**, shows the number of tarts of different types delivered to 3 different bakeries each day.

	Chocolate	Fruit	
$\mathbf{P} =$	$\begin{pmatrix} 210 & 160 \\ 95 & 120 \\ 150 & 180 \end{pmatrix}$		Bakery A
			Bakery B
			Bakery C

- (a)** Evaluate $\mathbf{M} = 7\mathbf{P}$.

Answer $\mathbf{M} =$ [1]

- (b)** Chocolate tarts cost \$3.60 each to make.
Fruit tarts cost \$5.20 each to make.
Represent these amount in a 2×1 matrix **S**.

Answer $\mathbf{S} =$ [1]

- (c)** Evaluate the matrix $\mathbf{C} = \mathbf{MS}$.

Answer $\mathbf{C} =$ [2]

- (d)** State what each of the elements of **C** represents.

Answer
..... [1]

23 (a) Simplify $3(2x - 5y) - (2y - 7x)$.

Answer [2]

(b) Factorise completely $pq + 2p - pqr^2 - 2pr^2$.

Answer [3]

24 It is given that $\frac{5}{p} = \sqrt{\frac{r+2}{qr}}$.

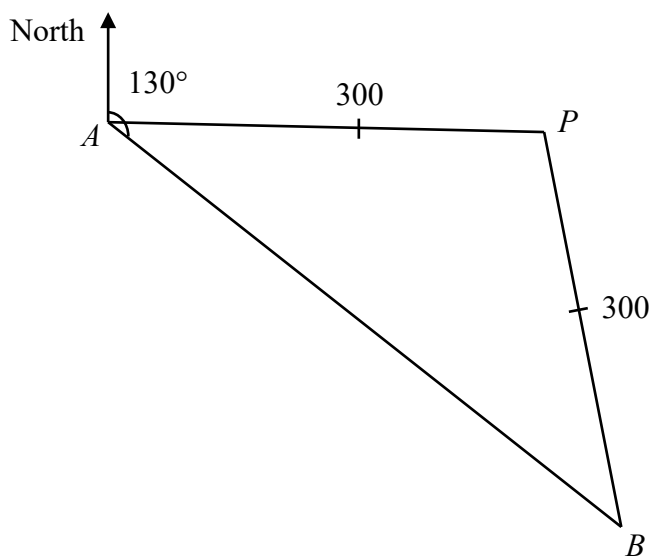
(a) Express r in terms of p and q .

Answer $r = \dots\dots\dots$ [4]

(b) Hence find r when $p = 1$ and $q = 2$.

Answer $r = \dots\dots\dots$ [1]

- 25 A , P and B are points on horizontal ground.
 $AP = PB = 300$ m.
 The bearing of B from A is 130° .



Given that P is due east of A , find

- (a) the bearing of A from B ,

Answer [1]

- (b) the bearing of B from P .

Answer [2]

A student, S , runs in a straight line from A to B .

(c) Calculate the shortest distance of S from P during the journey.

Answer m [2]

P is a point at the base of a tower.

R is the point on the top of the tower vertically above P .

The height of the tower is 200 m.

(d) Calculate the greatest angle of elevation of R from S .

Answer [2]

END OF PAPER

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ANSWER KEY

1 100

2 0.683 or 2.46

3 24.70

5a 42 5b 27

6a $\left(x - \frac{3}{2}\right)^2 + \frac{15}{4}$

7 3 : 4

8a 56 8b 15

9a 5.1×10^{-8} 9b 2.601×10^{-15} 9c 4×10^8

10a $x < \frac{1}{2}$ 10c 0

11a 62 10b 124 10c 117

12 $-\frac{1}{2}$ or -5

13a $n^2 + 4$ 13b $2n + 1$

14a 1 : 250 000 14b 2.625

15a 10 15b 44

16b 1, 2, 4, 5, 6, 8, 9, 10 16c 8

17a $2 \times 3^2 \times 7$ 17b $2 \times 3^2 \times 7 \times 11$ 17c 213 444 17d 9

18a $P(-1, 0)$ $Q(5, 0)$ $R(0, 5)$ 18b $(2, 9)$

20b 28.624

21ai 19 21aai 81

22a $\begin{pmatrix} 1470 & 1120 \\ 665 & 840 \\ 1050 & 1260 \end{pmatrix}$ 22b $\begin{pmatrix} 3.60 \\ 5.20 \end{pmatrix}$ 22c $\begin{pmatrix} 11116 \\ 6762 \\ 10332 \end{pmatrix}$

23a $13x - 17y$ 23b $p(q + 2)(1 + r)(1 - r)$

24a $\frac{2p^2}{25q - p^2}$ 24b $\frac{2}{49}$

25a 310 25b 170 25c 193 25d 46.0