Name: _____

IC No.: _____

Seat No: _____

BCA ACADEMY

SCHOOL OF BUILDING & DEVELOPMENT

SINGAPORE

MATHEMATICS SCREENING TEST (SET J)

1.5 HOURS

Instructions to candidates

1. Do **not** turn over this page until you are told to do so.
2. Check that you have the correct exam paper, number of pages and questions.
3. This paper consists of **TEN (10)** questions (100 marks). Answer ALL questions
4. Write your **Name, IC NO. and Seat No.** on this cover page.
5. All answers are to be written in THIS booklet.
6. Do **NOT** tear out any page. This booklet is the property of BCA Academy and **must not be removed** from the test centre.
7. All mobile phones and electronic equipment are to be switched off.
8. Candidates are to bring their own non-programmable scientific calculator.
   - Unless otherwise stated, leave your answers in 3 significant figures.
   - Unless the questions require the answers in term of π, the calculator value for $\pi = 3.142$ should be used.
   - If working is needed for any question, it must be shown with the answer. Omission of essential working will result in loss of marks.

For Official Use:	Test Centre:	Test Date:	Marks: (/100)
	Marker:	Checker:	

This question paper consists of 10 printed pages (excluding this page)

1. Simplify the following expressions: (10 marks)

   (a) $((-16 - (-2 + 1)) \times 2) / 5$

   (b) $((-6 \times 10^{2x}) 2 \times 10^{3y}) / -3 \times 10^{-3z}$

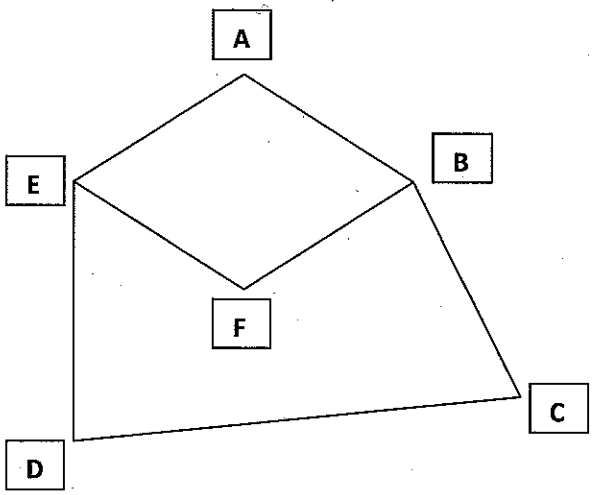
2. Simplify the following equations: (10 marks)

(a) $\dfrac{(9a^2 - x^2)}{(3a + x)(3a + x)^0}$

(b) $(-4y^4 z^4)(-3y^5 z^{-3}) - 11y^9 z$

3. A box has height = H cm, length = L cm and width = W cm. The dimension of this box is such that the height is 2 times the length and 4 times the width. Given that the total surface area of the box is 120 cm^2, determine the dimensions of the box. [Formulae: Surface area of a box = (2hl)+(2lw)+(2wh)] (10 marks)

4. ABFE is a parallelogram and angle A = 110 degrees. Find the sum total of all internal angles A, B, C, D and E. (10 marks)



5. In the diagram, the points A, B, C and D lie on a circle, centre O. AOC is a diameter and ED is a tangent of the circle. $\angle ADO = 34^\circ$ and $\angle BAC = 28$. Calculate

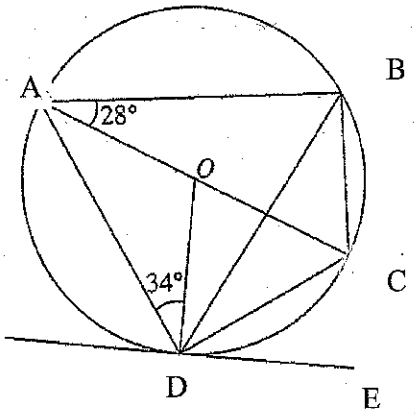
(a) $\angle CDE$

(b) $\angle ABD$

(c) $\angle BDO$

(d) $\angle BCD$

(10 marks)



6. A right-angled triangle KLM with angle M = 90° and base KM = 10 cm and height LM = 12 cm. Calculate the following: (10 marks)

(a) sin $\angle LKM$

(b) cos $\angle LKM$

(c) $\angle LKM$

7. OAB and ORS are two sectors with common centre O and radii OA and OR respectively. PQRS a rectangle in which PQ = 18 cm and QR = r cm. RS is tangent to the arc ANB at N, PO = OQ and MN = 4 cm.

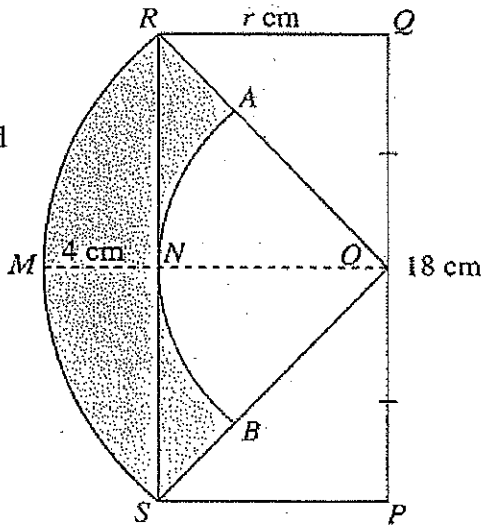
Calculate

(a) $\angle$ROS in radians,

(b) the perimeter of the shaded region, and

(c) the shaded area.

(10 marks)



8. An aircraft travelling at a speed of 300 miles per hour (mph) encounters a cross wind of 20 mph perpendicular to its flight path.

   (a) Draw a diagram to show the resultant vector (5 marks)

   (b) Calculate the resultant speed and direction of the aircraft (5 marks)

9. A jar contains two red marbles, three blue marbles, and four green marbles. Charlie draws one marble from the jar, and then David draws a marble from those remaining. What is the probability that Charlie draws a green marble and David draws a blue marble? Express your answer as a common fraction. (10 marks)

10. (a) Simplify (5 marks)

$$\log_3 144 \cdot \log_{12} 81 \cdot \log_9 27.$$

(b) Given that $\sin 40° = x/y$, express the following in terms of x and y. (5 marks)

(i) $\tan 40°$

(ii) $\cos 40°$

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14) $((-16-(-2+1)\times 2)/5$

$= ((-16-(-1)\times 2)/5$

$= ((-15)\times 2)/5$

$= -30/5$

$= -6$ *

15) $((-6\times 10^{2x})^{2}\times 10^{3y})/-3\times 10^{-3z}$

$= \left(\frac{-600\times 2500}{0.003}\right)\times 10^{8xyz}$

$= 4\times 10^{8xyz}$ *

24) $\frac{9a^2 - x^2}{(3a+x)(3a+x)^0}$

$= \frac{(3a)^2 - x^2}{(3a+x)\,1}$

$= \frac{[(3a)+x][(3a)-x]}{(3a+x)}$

$= 3a - x$ ✱

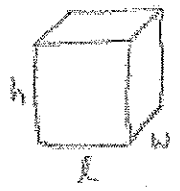
25) $(-4y^4z^4)(-3y^5z^{-3}) - 11y^9z$

$= (-12\,y^{4+5}z^{4-3}) - 11y^9z$

$= -12y^9z - 11y^9z$

$= y^9z$ ✱

3)



Given $\ell = 2w$

$h = 4w$

$A_s = 120$

$$(2\,hl) + (2\,\ell w) + (2\,wh) = A_s$$

$$2(4w)2w + 2(2w)w + 2w(4w) = 120$$

$$16w^2 + 4w^2 + 8w^2 = 120$$

$$28w^2 = 120$$

$$w = \underline{2.07}\ *$$

$$\ell = \underline{4.14}\ *$$

$$h = \underline{8.28}\ *$$

4) Total Sum of Internal $\angle ABCDE$

$$= (n-2)\,180^\circ$$

Since $n = 5$,

$$\therefore\ (5-2)\,180^\circ = 3(180^\circ)$$

$$= 540^\circ\ *$$

50) $\angle CDA = 90^\circ$ ($\perp$ in semi-circle)

$\angle ODC = 90^\circ - 34^\circ = 56^\circ$

$\angle ODE = 90^\circ$ (tangent)

$\therefore \angle CDE = 90^\circ - 56^\circ$

$= \underline{34^\circ}$ #

51) $\angle AOD = 180^\circ - 34^\circ - 34^\circ = 112^\circ$

$\therefore \angle ABD = \frac{112^\circ}{2} = \underline{56^\circ}$ # (∠ @ centre = 2 × ∠ @ circum)

52) $\angle BDC = 28^\circ$ (∠ of same segment of circle)

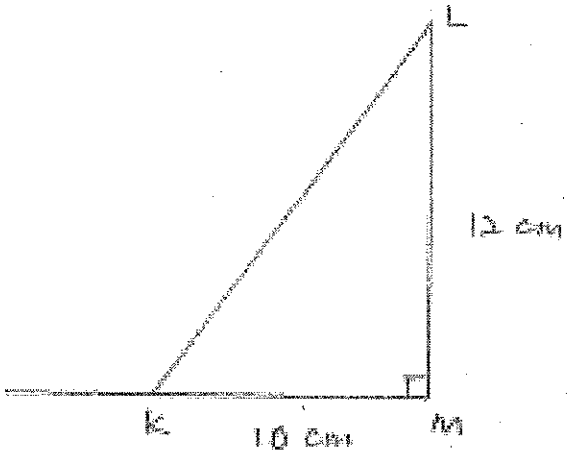
$\therefore \angle BDO = 56^\circ - 28^\circ$

$= \underline{28^\circ}$ #

53) $\angle OAD = 34^\circ$

$\therefore \angle BCD = 180^\circ - 34^\circ - 28^\circ$ (∠ in opposite segment of circle)

$= 118^\circ$



$$KL = \sqrt{10^2 + 12^2} = \sqrt{244}$$

(6a) $\sin \angle LKM = \frac{12}{\sqrt{244}} = \underline{0.768}$ *

(6b) $\cos \angle LKM = \frac{10}{\sqrt{244}} = \underline{0.640}$ *

(6c) $\angle LKM = \cos^{-1} 0.640$

$= 50.19^\circ$

7a) In $\triangle RNO$; $RN = \frac{18}{2} = 9$ cm

$NO = r$ cm $= AO$

$RA = MN = 4$ cm.

Using Pythagoras Theorem,

$RO^2 = 9^2 + r^2$

$(r+4)^2 = 81 + r^2$

$r^2 + 8r + 16 = 81 + r^2$

$\Rightarrow 8r = 81 - 16 = 65$

$r = \frac{65}{8} = 8.125$ cm

Sin $\tan\theta = \frac{\text{opp}}{\text{adj}}$; $\tan \angle RON = \frac{9}{\frac{65}{8}}$

$\therefore \angle RON = 0.8365$ rad

$\angle ROS = 1.673$ rad

7b) Arc $ANB = 8.125 \times 1.673 = 13.593$ cm

Arc $RMS = (8.125+4)1.673 = 20.285$ cm

Perimeter $= 13.593 + 4 + 20.285 + 4$

$= \underline{41.878}$ cm

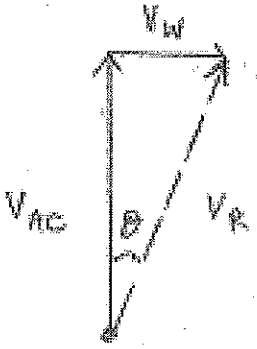
7c) Area $ORS = \frac{1}{2}(8.125+4)^2 1.673 = 132.939$

Area $OAB = \frac{1}{2}(8.125)^2 1.673 = 55.222$

$\therefore$ Area of shaded region $= 132.939 - 55.222$

$= \underline{67.717\ cm^2}$

8a)



where V_{AC} = aircraft velocity

V_W = wind velocity

8b) $\therefore V_R = \sqrt{300^2 + 50^2}$

$= \sqrt{90400}$

$= 300.666$ mph

$\tan\theta = \frac{opp}{adj}$

$= \frac{20}{300}$

$= 0.067$

$\therefore \theta = 3.814^\circ$

9) Total marbles = 2 + 3 + 4 = 9

$P_{\text{Chocolate}} = \frac{4}{9}$

$P_{\text{Round}} = \frac{3}{8}$

$\therefore P_{\text{Chocolate + Round}} = \frac{4}{9} \times \frac{3}{8}$

$= \frac{12}{72}$

$= \frac{1}{6}$ Ans

10a) $\log_3 144 \cdot \log_{12} 81 \cdot \log_9 27$

$= \log_3 12^2 \cdot \log_{12} 9^2 \cdot \log_9 3^3$

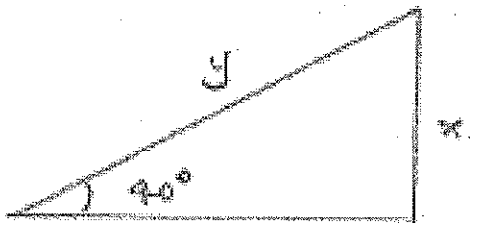
$= 2\log_3 12 \cdot 2\log_{12} 9 \cdot 3\log_9 3$

$= (2\times2\times3)\log_3 12 \cdot \log_{12} 9 \cdot \log_9 3^3$

$= (12)\ \frac{\log 12}{\log 3} \cdot \frac{\log 9}{\log 12} \cdot \frac{\log 3}{\log 9}$

$= 12$ //

10b)



$adj = \sqrt{y^2 - x^2}$

(i) $\therefore \tan 40^\circ = \frac{opp}{adj} = \frac{x}{\sqrt{y^2-x^2}}$

(ii) $\therefore \cos 40^\circ = \frac{adj}{hyp} = \frac{\sqrt{y^2-x^2}}{y}$