Brookside MATHLETE

Achieve Academic Excellence Through Maths

MOMBASA COUNTY EXAMINATION

10TH MARCH 2018

ALLIDINA VISRAM HIGH SCHOOL
SENIOR CATEGORY
[FORM 3 & FORM 4]

INSTRUCTIONS:

1. The Duration for This Exam is 2 Hours
2. Answer ALL the questions in the Answer Sheet Provided
3. Write ONLY the final answers in the Answer Sheet provided
4. For every question (or sub-section), only ONE answer is allowed.
5. Non-programmable electronic calculators and KNEC mathematical tables may be used; EXCEPT where stated otherwise.
6. 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.
7. For π, use $\frac{22}{7}$. Unless stated otherwise

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1. The value of a two-digit number is 9 more than the value of the number formed by reversing its digits. The sum of the two digits is 5. Find the numbers.

2. An arc of length x cm subtends an angle of $\left(\frac{p}{\pi}\right)^0$ at the centre of the circle. Find an expression for the radius r of the circle in terms of x and p

3. The sum of interior angles of two regular polygons of sides $(n-1)$ and n are in the ratio 3:4. Calculate the interior angle of the smaller polygon.

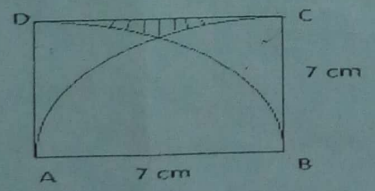
4. Determine the equation of the image of the line $y = 2x + 3$ after a reflection in the line $y = 1$

5. Find the surface area of a right pyramid whose base is a regular octagon of side 6 cm and height 15 cm.

6. Solve the inequality $6x - 13 \leq 17 < 8x - 7$

7. A frustum is cut from a cone whose radius is r cm and height h cm. If the height of the frustum is t cm, express the volume of the frustum as a fraction of the volume of the cone

8. BD and AC are arcs of equal quadrants centres A and B respectively. Calculate to 2 decimal places, the area of the shaded part. Take $\pi = \frac{22}{7}$



2.1157cm²
2.12cm²

9. Without using tables or calculator, simplify $\frac{(2+\sqrt{3})^4}{(2-\sqrt{3})^4}$

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10. The lines $y + 2 = 0$ and $x - 3 = 0$ are tangents to a circle whose centre is in the fourth quadrant. The diameter of the circle is 10 units. Determine the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$.

$x^2 + y^2 - 16x + 14y + 88 = 0$.

11. A matatu covered a distance of 270 km in 3.6 hours. Calculate the percentage error in its speed giving the answer to 3 significant figures.

12. Consider a right-angled triangle with sides a, b and c such that $a^2 + b^2 = c^2$. The inscribed circle has radius r while the circumscribed circle has the radius R. Find $\frac{r}{R}$

13. The sum of the first six terms of an arithmetic progression is 51 and the sum of the next six terms of the same A.P is 159. Find the second term of the A.P.

14. R varies partly as the square of V and partly as the cube of V. When $V = 2$, $R = -20$ and when $V = -3$, $R = 135$. Find the relationship between R and V.

15. A point Q divides a line PR internally in the ratio $2:1$ and a point T divides the line PQ internally in the ratio $3:1$. In what ratio does T divide QR? $-2:1$

16. The cash price of a television set is Ksh 13800. A customer opts to buy the set on hire purchase by paying a deposit of Ksh 2280. If the simple interest of 20% p.a is charged on the balance and the customer is required to repay by 24 equal monthly installments, calculate the amount of each installment.

17. The probability that a man wins a game is $\frac{3}{4}$. He plays the game until he wins. Determine the probability that he wins in the fifth round.

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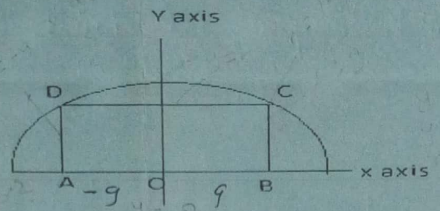
18. If $a = \log_{10} 12$ and $b = \log_2 12$, express $\log_6 10$ in terms of a and b.

$\frac{b}{a(b-1)}$ or $\frac{b}{ab-a}$

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19. In a mathematics examination the mean mark of 10 students is 47, while the standard deviation is 11. If the eleventh student scored 58, calculate to 2 decimal places the new standard deviation.

20. The figure below shows the curve $y = 12 - x^2$. OA=OB and ABCD is a rectangle. Find the maximum area of the rectangle.

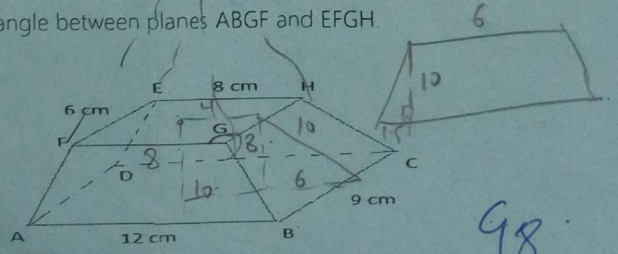


21. A and B are two points on latitude 40^0N. The two points lie on longitudes 20^0W and 100^0E respectively. Calculate the shortest distance in km from A to B giving answer to four significant figures. Take $\pi = \frac{22}{7}$ and radius of the earth as 6370 km.

22. Estimate the area enclosed by the curve $y = \frac{1}{2}x^2 + 5$, the x axis, the line $x = 1$ and $x = 5$ using trapezium rule with five trapezia.

23. Two points on the line $x + 2y = 6$ are each $\sqrt{17}$ units from the origin. Find the distance to one decimal place between the points.

24. The figure below shows a frustum of a right pyramid. The height of the frustum is 10cm. Calculate the angle between planes ABGF and EFGH.



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25. Describe all the transformations that maps $y = \sin x$ onto $y = 2\cos(x - 10)$

$y = \cos(x - 10) = 2\cos(x - 10)$

26. The velocity $v\ m/s$ of a particle moving along a straight line after t seconds is given by $v = 9t - \frac{3}{2}t^2 + 7$. Calculate the maximum velocity of the particle.

At max velo = acceleration (a) = 0 zero 20·5

27. M is a stretch with x axis invariant and scale factor 3 while N is a shear with x axis invariant and J (0, 1) is mapped onto J' (4, 1). Determine a single matrix representing N followed by M.

$\begin{pmatrix} 3 & 12 \\ 0 & 1 \end{pmatrix}$

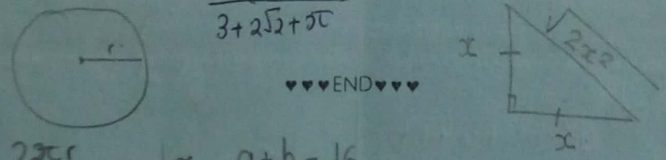
28. The area of triangle FGH is $21cm^2$. The triangle FGH is transformed using the matrix $\begin{pmatrix} 4 & 5 \\ 1 & 2 \end{pmatrix}$. Calculate the area of the image of triangle FGH.

29. The variance of three numbers 2, 8 and y is 6. Determine the value of y.

30. A thin wire 16 cm long is cut into two pieces, one of which is bent in a circle of radius r and the other into a right angled isosceles triangle. Determine the value of r, for which the sum of their areas is a minimum. Leave your answer in π and surd form.

$r = \frac{8}{3 + 2\sqrt{2} + \pi}$

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$a + b = 16$

$2\pi r + 2x + \sqrt{2x^2} = 16$

$2(\pi r + 2)$

$2\pi r + 2x + \sqrt{2x^2} = 16$

$r^2 + \frac{1}{2}x^2$

$2\pi r - 32 + \frac{4}{3}\pi r x + 2\pi^2 r^2 + 2x^2 \quad 2x^2 = (16 - 2\pi r - 2x)^2$

$16\pi r - 16x + \frac{2}{3}\pi r x + x^2 r^2 + x^2 + \pi r^2$

$16\pi + \frac{1}{2}\pi x + \frac{1}{2}x^2 r + 2\pi r = 0$

$16(16 - 2\pi r - 2x) - 2\pi r(16 - 2\pi r - 2x)$

$- 2x(16 - 2\pi r - 2x)$

$256 - 32\pi r - 32x - 32\pi r + 4\pi^2 r^2 + 4\pi r x + 32$

$+ 4\pi r x + 4x^2$

$16 + 2x + 2\pi r + 2r$

$8 + x + \pi r + r$

$x + r(\pi + 1)$

$r = \frac{8 - x}{\pi + 1}$

$\frac{256 - 64\pi r - 64x + 8\pi r x + 4\pi^2 r^2 + 4x^2}{2}$

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