

SECTION A (50 MKS)

Answer all the questions from this section in the spaces provided

1. Use logarithms to 4 decimal places to evaluate. (4mks)

$$\left(\frac{0.7841 \times \sqrt{0.1356}}{\log 84.92} \right)^{\frac{1}{3}}$$

2. Simplify the following surds leaving your answer in the form $a + b\sqrt{c}$ (3mks)

$$\frac{\sqrt{5}}{2\sqrt{2} - \sqrt{5}} + \frac{\sqrt{2}}{2\sqrt{2} + \sqrt{5}}$$

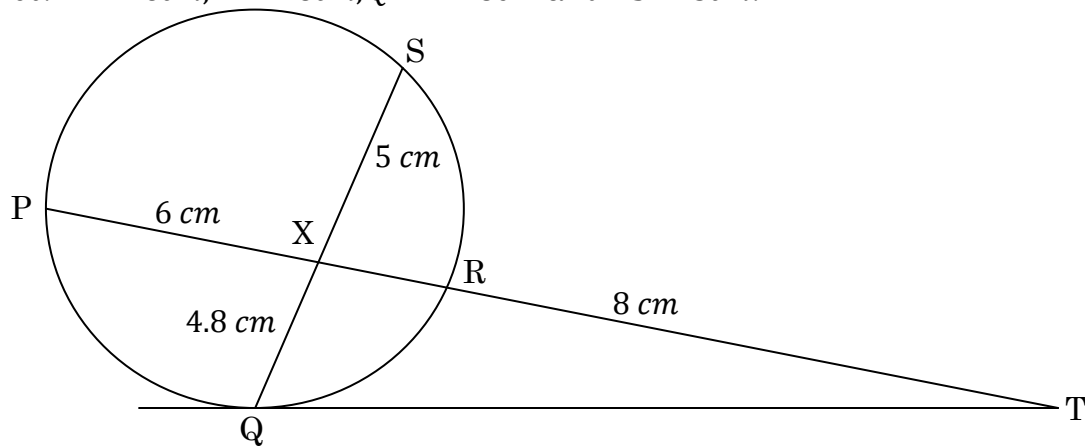
3. Using binomial expansion to expand $\left(2 + \frac{3}{x}\right)^6$ up to x^{-4} hence use the expansion to evaluate $(9.5)^6$. (3mks)

4. Make n the subject of the formula.

(3mks)

$$E = \left(\frac{n(n-x)}{n-1} \right)^{\frac{1}{2}}$$

5. In the figure below QT is a tangent to the circle at Q. PXRT and QXS are straight lines. $PX = 6\text{ cm}$, $RT = 8\text{ cm}$, $QX = 4.8\text{ cm}$ and $XS = 5\text{ cm}$.



Find the length of QT.

(3mks)

6. Find the equation of the normal to the curve $y = \frac{4x^3+4}{x^2}$ at the point $x = 2$. (3mks)

7. State the period and phase angle of $y = 2 \sin\left(\frac{1}{2}x + 30^\circ\right)$

(a) Period. (1mk)

(b) Phase angle. (1mk)

8. A quantity x is partly constant and partly varies as y . If $y = 1$ when $x = 12$ and $y = 12$ when $x = 23$. Find the value of x when $y = 5$. (3mks)

9. Draw line $PQ = 4cm$. Indicate by shading the region within which a variable point A must lie if $PA \leq 3cm$ and $PA > AQ$ (3mks)

10. Simplify completely

(3mks)

$$\frac{3x^2 - 5xy - 2y^2}{y^2 - 9x^2}$$

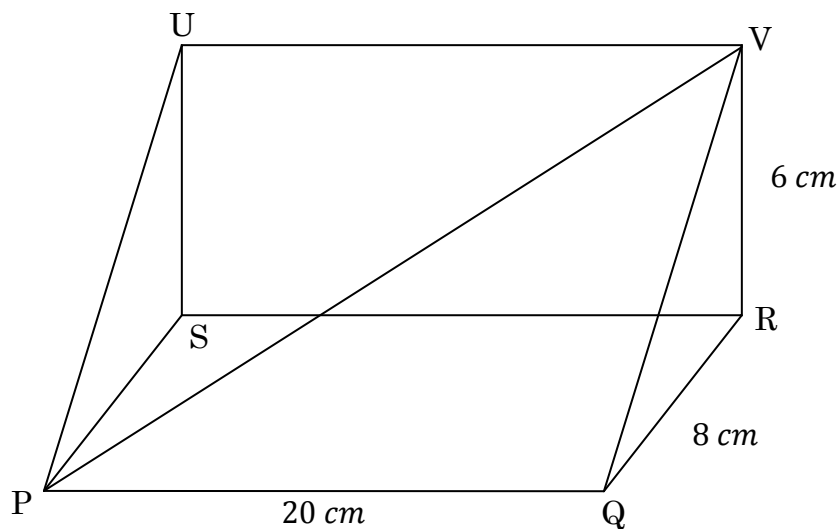
11. Solve for x in the equation.

(3mks)

$$\log_{10}(3x + 2) - 1 = \log_{10}(x - 4)$$

12. In a transformation, an object with an area of 10cm^2 is mapped onto an image whose area is 60cm^2 . Given that the matrix of transformation is $\begin{pmatrix} y & y-1 \\ 2 & 4 \end{pmatrix}$, find the value of y . (3mks)

13. The diagram below represents a wedge whose cross-section is a right angle triangle. PQVU is a rectangle and the dimensions are shown.



Calculate to 2 decimal places;

- (a) The length of PV (2mks)

- (b) The size of the angle between PV and plane PQRS. (2mks)

14. Write an equation of a circle that has a diameter whose end points are $(2, 7)$ and $(-6, 15)$ in the form $x^2 + y^2 + ax + by + c = 0$ where a , b and c are integers
(3mks)

15. Solve the equation $2\sin^2(x - 30^\circ) = \cos 60^\circ$ for $0^\circ \leq x \leq 180^\circ$ (4mks)

16. A shopkeeper mixes rice worth Kshs.47 and Kshs.55 per kg, how many kilograms of each should be used to obtain 24kg of the mixture worth Kshs.52 per kg.
(3mks)

SECTION II (50MKS)

Answer any five questions in this section in the spaces provided.

17. A plane leaves airport $A(40^{\circ}S, 36^{\circ}W)$ at 1400hrs on Monday and flies due North to airport $B(50^{\circ}N, 36^{\circ}W)$.

- (a) Calculate the distance the plane covers in kilometres. (*Take $\pi = \frac{22}{7}$ and $R = 6370km$*) (3mks)

(b) After 45 minutes stoppage at B, the plane flies due East to airport C, distance of 2550 nautical miles from B. Find:

- i. The position of C (4mks)

- ii. The local time the plane lands at C if its average speed for the whole journey is $1200km/hr$. (*Take 1 nautical mile = 1.854km*) (3mks)

18. Income tax is charged on annual income at the rates shown below.

<i>Taxable annual income (k£)</i>	<i>Rate shs. Per k£</i>
1 – 2,300	2
2301 – 4,600	3
4601 – 6,900	5
6901 – 9,200	7
9201 – 11,500	9
11,501 and above	10

Personal relief ksh. 1,056 per month.

Insurance relief ksh. 480 per month.

Mr. Nyikuri earns a basic salary sh. 13,800 per month. In addition to his salary he get a house allowance of ksh.8,000 per month and medical allowance of sh. 5,000 per month. Calculate;

(a) Mr. Nyikuri's taxable income (2mks)

(b) Mr. Nyikuri's net tax per month in Kenya shillings. (5mks)

(c) Calculate Mr. Nyikuri's net monthly salary in Kenya shillings. (3mks)

19. An arithmetic progression has the first term as x and the common difference as d .

(a) Write down in terms of x and d , the 3^{rd} , 9^{th} and 25^{th} terms of the progression. (1mk)

(b) The progression is increasing and the 3^{rd} , 9^{th} and 25^{th} terms form the first three consecutive terms of a geometric series. If the sum of the 7^{th} and twice the 6^{th} term of the arithmetic progression is 78, calculate:

i. The first term and the common difference of the A.P. (6mks)

ii. The sum of the first nine terms of the A.P. (3mks)

20. A manager wishes to hire two types of machine. He considers the following facts:

	Machine A	Machine B
<i>Floor space</i>	2cm^2	3cm^2
<i>No. of men required to operates</i>	4	3

He has a maximum of 24m^2 of floor space and a maximum of 36 men available. In addition he is not allowed to hire more machines of type **B** than of type **A**.

If he hires x machines of type **A** and y machines of type **B**,

(a) Write down all the inequalities that satisfy the above conditions. (4mks)

(b) Represent the inequalities on the grid and shade the unwanted region. (4mks)

(c) If the profit from machine A is sh. 4 per hour and that from using B is shs.8 per hour. What number of machine of each type should the manager choose to give the maximum profit? (2mks)

21. A curve is represented by the following function; $y = 2x^3 - 3x^2 - 12x + 4$. Use the curve to answer the following questions;

(a) Find $\frac{dy}{dx}$ (1mk)

(b) Determine the values of the stationery points of the curve. (4mks)

(c) Determine the nature of each stationery point on the curve (2mks)

(d) In the space provided, sketch the curve of $y = 2x^3 - 3x^2 - 12x + 4$ (3mks)

22. A box has 32 compact disks. 4 of them are music disks, 12 have comedy movies and the rest are action movies.

(a) Find the probability of randomly picking;

i. A music compact disk. (1mk)

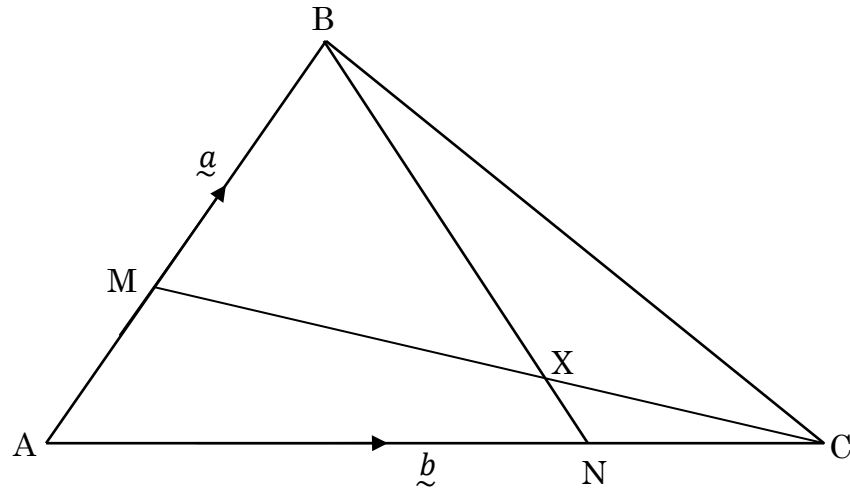
ii. An action movie or a comedy movie compact disk. (2mks)

(b) A girl picks three compact disks from the box at random, one at a time, without replacement. Find the probability that;

i. Either one compact disk is that of an action movie and the other is that of a comedy movie (4mks)

ii. Both compact disks are of the same type. (3mks)

23. In triangle ABC, shown below $\overrightarrow{AB} = \mathbf{a}$ and $\overrightarrow{AC} = \mathbf{b}$ point M lies on AB such that $\overrightarrow{AM} : \overrightarrow{MB} = 2 : 3$ and point N lies on AC such that $\overrightarrow{AN} : \overrightarrow{NC} = 5 : 1$ line BN intersects line MC at X.



- (a) Express the following in terms of $\mathbf{a}$ and $\mathbf{b}$
- $\overrightarrow{BN}$ (1mk)
 - $\overrightarrow{CM}$ (1mk)
- (b) Given that $\overrightarrow{BX} = k\overrightarrow{BN}$ and $\overrightarrow{CX} = r\overrightarrow{CM}$ where k and r are scalars
- Write two different expressions for $\overrightarrow{AX}$ in term of $\mathbf{a}$, $\mathbf{b}$, k and r . (3mks)
 - Find the values of k and r hence show that C, X and M are collinear. (5mks)

24. The quantities P and Q are connected by the equation $P = kR^n$. The table below shows values of P and R.

P	1.2	1.5	2.0	2.5	3.5	4.5
R	1.6	2.3	3.4	4.7	7.9	11.5

(a) State the linear equation connecting P and R. (1mk)

(b) Using a suitable scale, Draw a suitable line graph on the grid provided. (5mks)

(c) From the graph you have drawn, estimate the values of;
(i) n (2mks)

(ii) k (1mk)

(d) Find the linear law connecting P and R. (1mk)