INSTRUCTIONS: ANSWER ALL QUESTIONS **TIME: (1 HR 30 MINS)**

1. The sum of the first 3 terms of a geometric series is 26. If the common ratio is 3. Find the sum of the first 6 terms. (3 mks)

$S_n = \frac{a(r^n-1)}{r-1}$ M_1

$26 = \frac{a(3^3-1)}{2}$

$a = 2$ M_1

$S_6 = \frac{2(3^6-1)}{2}$

$= 728$ M_1

2. a. Use matrix method to solve the following simultaneous equation. (3 mks)

x-2y=4

2x+y=3

$\begin{pmatrix} 1 & -2 \\ 2 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$

Det $= 1 - -4 = 5$

$\frac{1}{5}\begin{pmatrix} 1 & 2 \\ -2 & 1 \end{pmatrix}\begin{pmatrix} 1 & -2 \\ 2 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{5}\begin{pmatrix} 1 & 2 \\ -2 & 1 \end{pmatrix}\begin{pmatrix} 4 \\ 3 \end{pmatrix}$ M_1

$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{1}{5} & \frac{2}{5} \\ -\frac{2}{5} & \frac{1}{5} \end{pmatrix}\begin{pmatrix} 4 \\ 3 \end{pmatrix}$

$x = \frac{1}{5} \times 4 + \frac{2}{5} \times 3 = 2$ M_1

$y = -\frac{2}{5} \times 4 + \frac{1}{5} \times 3 = -1$ M_1

b. Given $P = \begin{bmatrix} 1 & 2 \\ 0 & 4 \end{bmatrix}$ $Q = \begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix}$ and $R = \begin{bmatrix} 3 & 0 \\ 2 & 2 \end{bmatrix}$ find:

PQR. (3 mks)

$PQ = \begin{bmatrix} 1 & 2 \\ 0 & 4 \end{bmatrix}\begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix} = \begin{bmatrix} 4 & 6 \\ 4 & 12 \end{bmatrix}$

$PQR = \begin{bmatrix} 4 & 6 \\ 4 & 12 \end{bmatrix}\begin{bmatrix} 3 & 0 \\ 2 & 2 \end{bmatrix} = \begin{bmatrix} 24 & 12 \\ 36 & 24 \end{bmatrix}$

½Q+P. (3 mks)

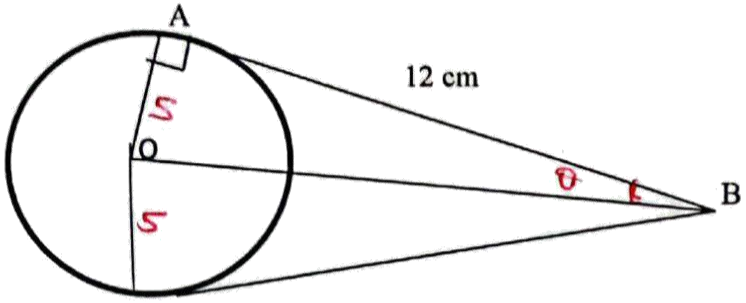
$\frac{1}{2}Q = \frac{1}{2}\begin{bmatrix} 2 & 0 \\ 1 & 3 \end{bmatrix}$

$= \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & \frac{3}{2} \end{bmatrix}$

$= \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & \frac{3}{2} \end{bmatrix} + \begin{bmatrix} 1 & 2 \\ 0 & 4 \end{bmatrix}$

$= \begin{bmatrix} 2 & 2 \\ \frac{1}{2} & \frac{11}{2} \end{bmatrix}$

3. In the figure below the tangent AB and BC are 12 cm long, with O as the centre of the circle and the radius 5 cm find



a.OB

$OB = \sqrt{12^2 + 5^2} = \sqrt{169} = 13$

b. Angle ABC

$\tan\theta = \frac{5}{12}$

$\theta = \tan^{-1}\left(\frac{5}{12}\right) = 22.62^\circ$

$ABC = 2 \times 22.62$

$= 45.24^\circ$

4. The cash price of a phone is sh 9000. A customer bought the phone by paying 15 monthly installments of 950 each. Calculate the carrying charge and the rate of compound interest (4 mks). Use deposit of 2,500

C.P → 9 000

15 × 950 = 14,250

H.P.P = 14250 + 2500

= Sh. 16750

Interest = 16750 − 9000

C. charge = Sh. 7750

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

$14250 = 6500\left(1 + \frac{r}{100}\right)^{15}$

$2.1923 = \left(1 + \frac{r}{100}\right)^{15}$

$(2.1923)^{\frac{1}{5}} = 1 + \frac{r}{100}$

$1.17 = 1 + \frac{r}{100}$

$0.17 = \frac{r}{100}$

$r = 17\%$

5. Find the equation of a circle of centre (2,1) and radius $\sqrt{13}$. (2 mks)

$C(2,1),\ r = \sqrt{13}$ M_1

$(x-h)^2 + (y-k)^2 = r^2$

$(x-2)^2 + (y-1)^2 = (\sqrt{13})^2$

$x^2 - 4x + 4 + y^2 - 2y + 1 = 13$

$x^2 + y^2 - 4x + 2y = 8$ M_1

6. Find the value of y. (3 mks)

$2 + \log 3 + \log y = \log 5 + 1$

$1 + \log 3 + \log y = \log 5$

$1 = \log 10$ M_1

$\log 10 + \log 3 = \log 5 - \log y$ M_1

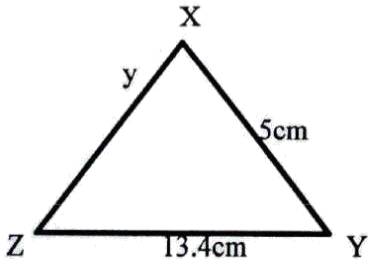
$\log(10 \times 3) = \log\left(\frac{5}{y}\right)$

$30 = \frac{5}{y}$ $y = \frac{5}{30} = \frac{1}{6}$

$y = \frac{1}{6}$ M_1

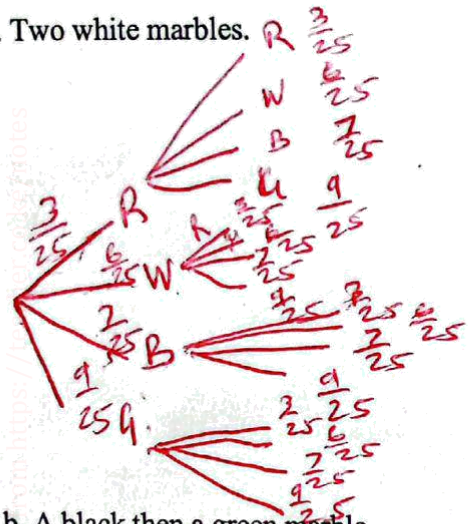
7. Find the values of x,y and z in the following triangles

(4 mks)



8. Two marbles are picked in turn with replacement from a pack containing three red marbles, six white marbles, 7 black marbles and 9 green marbles. Using a tree diagram, determine the probability of picking: (5 mks)

a. Two white marbles.



$\frac{6}{25} \times \frac{6}{25} = \frac{36}{625}$

b. A black then a green marble.

$\frac{7}{25} \times \frac{9}{25} = \frac{63}{625}$

c. No red marble.

(WW or WB or WB) or (BW or BBB G) or (GW or GB or G

9. The resistance to the motion of a bicycle is partly constant and partly varies as the square of the speed . The resistance is 265 N when the speed 20 km/h and 365 N when the speed is 30 km/h. Find the resistance when the speed is 35 km/h. (4 mks).

Let resistance be R & Speed be S.

$R \propto S^2 + C$

$R = kS^2 + C$

$265 = 400k + C$ M_1

$365 = 900k + C$

$-100 = -500k$

$k = \frac{1}{5}$ M_1

$C = 265 - 400(\frac{1}{5}) = 185$ M_1

$S = 35$ km/hr.

$R = \frac{1}{5} \times 35^2 + 185$

$= 430$

$R = 430$ N

10. Using Pascal's triangle expand the following. (4 mks)

(1 6 15 20 15 6 1)

a.$(P + Q)^6$ $(p+q)^6$

$= {}^6C_0 p^6 q^0 + {}^6C_1 p^5 q^1 + {}^6C_2 p^4 q^2 + {}^6C_3 p^3 q^3 + {}^6C_4 p^2 q^4 + {}^6C_5 p^1 q^5 + {}^6C_6 p^0 q^6$ M_1

$= p^6 + p^5 q + p^4 q^2 + p^3 q^3 + p^2 q^4 + p q^5 + q^6$

$= p^6 + 6p^5 q + 15p^4 q^3 + 20p^3 q^3 + 15p^2 q^4 + 6pq^5 + q^6$ M_1

b.$(2x + 3y)^6$ $(2x+3y)^6$

$({}^6C_0)(2x)^6(3y)^0 + ({}^6C_1)(2x)^5(3y)^1 + ({}^6C_2)(2x)^4(3y)^2 + ({}^6C_3)(2x)^3(3y)^3 + ({}^6C_4)(2x)^2(3y)^4 + ({}^6C_5)(2x)^1(3y)^5 + ({}^6C_6)(2x)^0(3y)^6$ M_1

$64x^6 + 96x^5y + 144x^4y^2 + 216x^3y^3 + 324x^2y^4 + 486xy^5 + 729y^6$

$64x^6 + 576x^5y + 2160x^4y^2 + 4320x^3y^3 + 4860x^2y^4 + 2916xy^5 + 729y^6$ M_1

11. The length of an arc of a circle is 11.0 cm. Find the radius of this circle if the arc substends 90° at the centre of the circle. (3 mks)

$11 = \frac{90}{360} \times 2\pi r$ M_1

$\frac{44}{2\pi} = r$, $r = 7\text{cm}$ M_1

12. Express in surd form and simplify $\frac{1+\cos 30°}{1-\sin 60°}$ (3 mks)

$\cos 30° = \frac{\sqrt{3}}{2}$ M_1

$\sin 60° = \frac{\sqrt{3}}{2}$

$\frac{(1+\frac{\sqrt{3}}{2})(1+\frac{\sqrt{3}}{2})}{(1-\frac{\sqrt{3}}{2})(1+\frac{\sqrt{3}}{2})}$ M_1

$= \frac{1+2\frac{\sqrt{3}}{2}+\frac{3}{4}}{1-\frac{3}{4}} = \frac{\frac{7}{4}+\sqrt{3}}{\frac{1}{4}}$

$= \frac{7+4\sqrt{3}}{4} \times 4 = 7+4\sqrt{3}$ M_1

13. The temperature of a body is measured and recorded as 29.5°c. Find the percentage error.(3 mks)

$29.5\,^{\circ}c$

$A.E = \frac{0.1}{2} = 0.05$ M_1

$29.55 - 29.5 = 0.05$

$29.5 - 29.45 = 0.05$ M_1

$A.E = \frac{0.05+0.05}{2} = 0.05$

$\%E = \frac{0.05}{29.5} \times 100\%$

$= 0.17\%$ M_1