## CHRISTMAS REVIEW PAPER

1. Simplify the expression $\frac{3 \sqrt{2}+2 \sqrt{3}}{3 \sqrt{2}-2 \sqrt{3}}$; Leave your answer in the form $a+b \sqrt{3}$ where $a, b$ and $c$ are rational numbers.
2. Calculate the length of the side marked $x$ in this right angled triangle.

Leave your answer in surd form.

3. Simplify (a)
4. Solve the following equations
(a) $\log _{x} 3+\log _{x} 27=2$
(b) $\log _{3} x++3 \log _{x} 3=4$
5. The population of a certain town has been falling at a constant rate each year. At the end of 1956 the population was 60,000 and after one year it has fallen to 57,000 .
(a) Find a model for the $n^{\text {th }}$ year after 1956.
(b) In which year did the population fall below 10,000 ?
6. Medical Researchers studying the growth of a strain of bacteria, observed that the number of bacteria present after' $t$ ' hours is given by the formula

$$
\mathrm{N}(\mathrm{t})=40 e^{1.5 t}
$$

(a) State the number of bacteria present at the start of the experiment.
(b) How many minutes will the bacteria take to double in number.
7. The value $\$ \mathrm{~V}$ of a particular car can be modeled by the equation

$$
\mathrm{V}=\mathrm{K} e^{-b t} \text { where } \mathrm{t} \text { years is the age of the car. }
$$

The car's original price was $\$ 7499$ and after one year it valued at $\$ 6000$.
State the value of k and calculate b giving your answer to two decimal places. Hence obtain the value of the car when it is 3years old.
8. The first terms of a G.P. are $k-3,2 k-4$, and $4 k-3$ in that order. Find the value of $k$ and the sum of the eight terms of the progression.
9. The sum of the first twenty terms of an arithmetic progression is 45 and the sum of the first forty terms is 290 .
(a) Find the first term and the common difference.
(b) Find the number of terms in the progression which are less than 100.
10. Expand $\left(2-\frac{X}{2}\right)^{5}$ in ascending power if $X$. Use the first four terms of the expansion to find an appropriate value of $(1.99)^{5}$
11. The coefficient of $X^{5}$ in the expansion of $(1+5 \mathrm{x})^{8}$ is equal to the coefficient of $X^{4}$ in the expansion of $(a+5 x)^{7}$. Find the value of " $a$ ".
12. Find the term independent of $x$ in the expansion $\left(x^{2}-\frac{2}{x}\right)^{6}$.
13. Write in full
(a) $\sum_{i=n-2}^{n} \frac{m}{m+1}$
(b) $\sum_{i=1}^{n}\left(m^{2}+m\right)$
(c) $\sum_{n}^{n+2} m(m-1)$
(d) Write in summation notation
(i) $1^{4}+2^{4}+\ldots \ldots \ldots \ldots . n^{4}+(n+1)^{4}$
(ii) $1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}$
(iii) $3^{2}+3^{3}+3^{4}+3^{5}$
(iv) $\frac{1 \times 3}{4}+\frac{2 \times 5}{6}+\frac{3 \times 7}{8}+\frac{4 \times 9}{10}+\frac{5 \times 11}{12}$
14. (a) Find $a^{2} b^{4}$ term of the expansion of $(2 a-3 b)^{6}$
(b) In the expansion of $(p x+1)^{6}$ the coefficient of the $x^{3}$ term is 160 . Find the value of $p$.
15. In a geometric sequence, the first term is 3 and the $6^{\text {th }}$ term is 96
(a) Find the common ratio.
(b) Find the least value of $n$ such that $U_{n}>3000$.
16. Given that $\mathrm{y}=\frac{27^{a}}{81}$ write $\mathrm{y}=\mathrm{pa}+\mathrm{q}$ where p and q are integers to be found.
17. Complete Quadratic worksheet as well

