National Junior College
2016 – 2017 H2 Mathematics
Revision: Exponential, Logarithmic and Modulus Functions and their Graphs

Practice Questions

1. Sketch the graph of $y=\log_3(x+4)$, labelling all axial intercepts and asymptotes in exact form.

2. Solve the following equations.

   (a) $|2x-3|=x$ (b) $|x+4|=|2-x|$

   (c) $|x^2+6|=5x$ (d) $|x+\sqrt{6}||x-\sqrt{6}|=-5x$

3. Find the values of a and b for which $2x^2+4x-3$ can be expressed in the form $2(x+a)^2+b$. Hence, sketch the curve $y=|2x^2+4x-3|$ for the interval $-3\le x\le 2$, Indicating the exact coordinates of the x-intercepts.4.

4. If $\frac{r^2}{4}(3x)^r\left(\frac{2}{9x^2}\right)^{6-r}$ can be simplified to $\frac{k}{x^3}$, find the values of the constants r and k.

5. (a) Use the substitution $y=3^x$ to find the values of x which satisfy the equation $3(9^x)-3^{x+1}+1=3^x$. [AO Maths N03/P1]

   (b) Solve the equation $2^{2x}-3(2^x)-10=0$. [AO Maths N05/P1]

6. A curve is defined by $y=k3^x$, where k is a constant. If the curve passes through the point $A(0,2)$, find the value of k, and sketch the curve for positive values of x.

7. Prove that $e^{\ln x}=x$.

8. If a, b, and c are positive numbers other than 1, show that

$$\log_b a\bullet\log_c b\bullet\log_a c=1.$$

9. Solve the following equations.

   (a) $\lg(2x+5)=1+\lg x$ (b) $\log_4 y+\log_2 y=12$ [AO Maths N01/P2]

   (c) $\lg(x+3)-\lg x=\lg 7$ (d) $\frac{8^{2y}}{4^{y+1}}=2^{2y+1}$ [AO Maths N02/P2]

10. Solve the following simultaneous equations.

    (a) $y+2x=3$ and $y=|2x-1|$ (b) $2x+3y=19$ and $|x-y|=3$

11. Solve the simultaneous equations given below:

(a) $\ln(3x-y)=2\ln 6-\ln 9$ and $\dfrac{\left(\mathrm{e}^{x}\right)^{2}}{\mathrm{e}^{y}}=\mathrm{e}$

(b) $3^{p}=9(27)^{q}$ and $\log_2 7-\log_2(11q-2p)=1$

12. Solve $\left|\mathrm{e}^{x}-2\right|=\mathrm{e}^{x}+1$.

13. 2012/H1/AJC/Promo/7

On first January 1990, Mr. Andrew invests \$1000 in an account with Bank A which pays 5% interest compounded annually on 31st December of each year. The amount of money in the account, \$*M*, at the end of *t* years is given by $M=1000(1.05)^{t}$.

(i) How much will there be in his account on 31st December 1997?

(ii) State the year when the amount of investment first exceeds \$4000.

Starting from 1990, Mr. Andrew also decides to save \$100 on 1st January every year in another account with Bank B which pays the same compound interest annually. The amount of money \$*N* at the end of *t* years is given by $N=2100(1.05^{t}-1)$.

State the year in which the money in the account with Bank B first exceeds the amount in the account with Bank A.

14. 2012/H1/NJC/Promo/4

(a) Solve $(\ln x)^{2}+2\ln x=3$, giving your answer in exact form.

(b) Show that $\log_2(a)=\log_4(3b+13)$ can be simplified to $a^2 = 3b + 13$.

Hence, find the exact values of *a* and *b* which satisfy the following simultaneous equations

$$3^{a}=\frac{9^{b}}{27},\qquad \log_2(a)=\log_4(3b+13)$$

*Majority of questions are taken from Panpac Additional Mathematics

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Numerical Answers

3. (a) $x=1,3$ (b) $x=-1$ (c) $x=2,3$ (d) $x=-1,-6$

4. $k=\dfrac{2}{3};r=3$ 5. (a) $x=-1,0$ (b) $x=\dfrac{\ln 5}{\ln 2}$

6. $k=2$ 9. (a) $x=\dfrac{5}{8}$ (b) $y=256$ (c) $x=0.5$ (d) $y=1.5$

10. (a) $x=1;y=1$ (b) $x=\dfrac{28}{5},y=\dfrac{13}{5};x=2,y=5$

11. (a) $x=3,y=5$ (b) $p=6.5,q=1.5$ 12. $x=-\ln 2$

13. (i) \$1477.46 (ii) 2018 (iii) 2003

14. (a) $x=\mathrm{e}^{-3},\mathrm{e}$ (b) $a=5,b=4$