CHEM 1251L.
Experiment 1
Introduction to Measurement and Technique.

Pre-Assessment.

1. $f(x) = 3(\frac{1}{2})^x$.

y-Intercept $x = 0$

$f(0) = 3(\frac{1}{2})^0 = 3$.

$f(-1) = 3(\frac{1}{2})^{-1} = 3 \times 2 = 6$.

$(0, 3)$ $(-1, 6)$.

Correct graph

$f(x) = 3(\frac{1}{2})^x$ is (C)

2. $g(x) = 3\cos(2x + \pi) + 1$.

Domain: all real numbers.

Range: $-2 \leq y \leq 4$.

(B)

3. $2^{x+14} = 16^{2x}$

$2^{x+14} = 2^{8x}$

$x + 14 = 8x \Rightarrow 8x - x = 14$.

$7x = 14$

$x = 2$.

(A)

4.

18400	21400	25000
15700	18400	21400
2700	3000	3600
29100	30,200	39700
25000	29100	34200
4100	5100	5500

$50,000 = 15700\, e^t$.

$e^t = 2$.

$t = 1$

50,000
39700
10300

(B)

5. $N = N_0 e^{kt}$.

$1200 = 1800 e^{0.015t}$.

$e^{0.015t} = \frac{1200}{1800} = \frac{2}{3}$.

$e^{0.015t} = \frac{2}{3}$.

$\ln e^{0.015t} = \ln \frac{2}{3}$

$0.015t = -0.40546$

$t = \frac{-0.40546}{0.015}$

$t = -27.03$.

$t \approx -27$ (A)

$\therefore$ 27 years ago.

6. $f(x) = \sqrt{2x + a}$ $(3, 4)$

$4 = \sqrt{2 \times 3 + a}$

$16 = 6 + a$.

$a = 16 - 6 = 10$.

$g(x) = \frac{1}{2}\sqrt{2x + a} \Rightarrow g(x) = \frac{1}{2}\sqrt{2x + 10}$

$(3, 2)$

$2 = \frac{1}{2}\sqrt{2 \times 3 + 10}$

$2 = \frac{1}{2}\sqrt{16}$

$2 = \frac{1}{2} \times 4$

$2 = 2$ true

$\therefore (3, 2)$ lies (C).

7. $\log_6 40 \Rightarrow$

Index.

let $\log_6 40 = x$

$6^x = 40$.

$\log_{10} 6^x = \log_{10} 40$.

$x \log_{10} 6 = \log_{10} 40$.

$x = \dfrac{\log_{10} 40}{\log_{10} 6}$. (D)

8. $y = 3x + 6$.

Inverse.

$x = 3y + 6$.

$3y = x - 6$

$y = \dfrac{x-6}{3}$ or $\dfrac{x}{3} - 2$

$y = \frac{1}{3}x - 2$. (A)

9. $f(x) = x^2 - x$, $g(x) = x - 1$

$f(g(x)) = (x-1)^2 - (x-1)$

$= (x-1)(x-1) - x + 1$

$= x^2 - x - x + 1 - x + 1$

$= x^2 - 2x + 1 - x + 1$

$f(g(x)) = x^2 - 3x + 2$. (C)

10. $\log_{10} x = -2$.

$10^{-2} = x$

$x = \dfrac{1}{10^2} = \dfrac{1}{100}$ (C)

11. $A(t) = a(1 \pm r)^t$.

$A(12) = 10,000(1 \pm 0.05)^{12}$

$A(12) = 10,000(1.05)^{12}$

or

$A(12) = 10,000(0.95)^{12}$

$A(12) = 17958.56$

or

$A(12) = 5403.60 \times$

$\therefore$ After 12 yrs. (D)

Amount = $\$17,958.56$.

12. $f(x) = \log 5x$.

$y = 0$

$0 = \log 5x \Rightarrow 10^0 = 5x$

$5x = 1$

$x = 1/5$

$(1/5, 0)$

Correct graph.

(D)

13. $y = \sqrt{x+3}$

$x = 0$

$y = \sqrt{3}$ $(0, \sqrt{3})$

$y = 0$

$x = -3$ $(-3, 0)$

Correct graph. (C)

14. $\log_3 27$

$= \log_3 3^3$ $\log_3 3 = 1$

$= 3 \log_3 3 = 3$

$\therefore \log_3 27 = 3$ (B)

15. $y = A\left(\frac{1}{2}\right)^{t/300}$

$y = 1000\left(\frac{1}{2}\right)^{\frac{900}{300}}$

$y = 1000\left(\frac{1}{2}\right)^{3}$.

$y = 1000\left(\frac{1}{2}\right)^{3}$

$y = 1000\left(\frac{1}{8}\right) = \frac{1000}{8}$

$y = 125$ grams (C)

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

$A = 25900(1-0.12)^{8}$

$A = 25900(0.88)^{8}$.

$A = 9314$

$\approx \$9300$ (C)

17. $f(x) = (3x-24)^2$.

$y = (3x-24)^2$

$x = (3y-24)^2$

$3y - 24 = \sqrt{x}$

$3y = \sqrt{x} + 24$

$y = \frac{1}{3}\sqrt{x} + 8$.

$f^{-1}(x) = \frac{1}{3}\sqrt{x} + 8$. (C)

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

$A = 500\left(1 + \frac{0.06}{4}\right)^{4t}$.

$A = 500(1.015)^{4t}$.

$500 \times 4 = 500(1.015)^{4t}$

$4 = (1.015)^{4t}$.

$\log(1.015)^{4t} = \log 4$

$4t \log(1.015) = \log 4$.

$4t = \frac{\log 4}{\log 1.015}$

$t = \frac{\log 4}{4 \log 1.015}$ (D)

19. $f(x) = x^3$, $g(x) = 4x + 3$.

$g(f(x)) = 4x^3 + 3)$

$g(f(3)) = 4(3)^3 + 3$.

$= 4 \times 27 + 3$

$= 108 + 3$

$g(f(3)) = 111$ B

20. $f(x) = x^2$, $g(x) = x - 2$.

$(f \circ g)(x) = (x-2)^2$.

$= (x-2)(x-2)$

$= x^2 - 2x - 2x + 4$

$(f \circ g)(x) = x^2 - 4x + 4$.

Domain: All real numbers.

Range: $y \geq 0$

(B)

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21. $e^x e^{2x} = 4$

$e^{x+2x} = 4$

$e^{3x} = 4$

$\ln e^{3x} = \ln 4$

$3x = \ln 4$

$x = \frac{\ln 4}{3}$ (D)

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22. bonus $\frac{4}{100} \times 15000 = 600$

$f(x) - g(x)$

(B)

23. ~~$3^4 = 81$~~

~~$4 \log 3 = \log 81$~~

23. $3^t = 81$

$\log_3 81 = 4$.

(D)

24. $\log_6 (x-4) = 0$.

$6^0 = (x-4)$

$6^0 = 1$ (A)

25. $\sqrt{x+16} = 3\sqrt{x}$

$x + 16 = 9x$

$9x - x = 16$

$8x = 16$

$x = 2$ (C)

26. $f(x) = 2x^2 + 8x - 4$

$g(x) = -5x + 6$.

$(f-g)(x) = 2x^2 + 8x - 4 - (-5x + 6)$

$= 2x^2 + 8x - 4 + 5x - 6$

$= 2x^2 + 13x - 10$

$(f-g)(x) = 2x^2 + 13x - 10$.

27. $f(n+1) = f(n) - 0.10 f(n) + 15$

(D)

28. $N = (50.06)(1.41)^x$

$x = 0$

$N = (50.06)(1.41)^0$

$N = 50.06$

≈ 50.

equation

$N = (50.06)(1.41)^x$

29. $y = 2^x$

$x = \frac{1}{4}$ (A).

30. $y = 20^{-3/2}$.

$y = \left(\frac{1}{20}\right)^{3/2}$

$y = 20^{-3/2}$.

$\log_{20} y = -\frac{3}{2}$.