

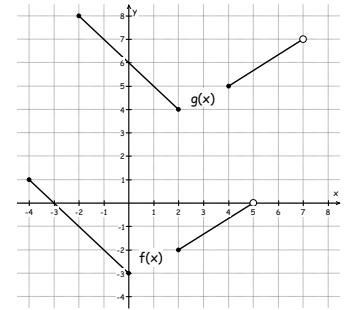
You must show the solution process not merely the answer to receive full credit. Write in a neat and organized fashion. Circle or box-in your answers. **Simplify and write exact values where possible.** 100 pts.

- 1) Give the equation of the line through (2, -2) & (-13, 23)
- 2) Solve for x using algebraic manipulation: $15 - 7 \frac{x-1}{2} = \frac{x}{4} + 3$
- 3) Solve for x using algebraic manipulation: $(x-5)(x+2) = 4(3x+11)$
- 4) Solve for y: $10 - \frac{5x-y}{3} = \frac{3y-2x+4}{5}$
- 5) Solve for y: $ax + by = 3x - 2y + 8$
- 6) Solve for x: $4e^{ax+b} - 5 = 11$
- 7) Solve for x: $\frac{\ln(ax+b)}{2} + 7 = 6$
- 8) Solve using the TI: $e^{-x/2} = 2 + \ln x$. Give the answer with 4 significant digits.
- 9) An insect population was 600 on May 1. 5 days later the population had increased to 1,430. Use $P(t) = P_0 e^{rt}$ with May 1 corresponding to $t = 0$. Determine r.
- 10) $P(t) = P_0 e^{-kt}$ models radioactive decay. Suppose you start with 200 grams of radioactive Silicon (Si) with a half-life of 140 yrs.
 - (a) What is the value for P_0 ?
 - (b) How much Silicon will be left in 500 yrs?
 - (c) How many years until the Silicon decays to 10 gms?
- 11) The mosquito population for Swamp Camp can be modeled by $M(t) = 500 + e^{-0.12t}$ Where $t = 0$ on June 1.
 - (a) What is the maximum mosquito population? Hint: Graph it.
 - (b) How many days until the mosquito population drops below 1 of the nasty little buggers?
- 12) Function 'f' represents the number of bugs counted (N) at time of day (T) with time in minutes starting at midnight for the next 24 hrs.
 - (a) Give the independent variable _____
 - (b) What does $f(7) = 8$ mean in terms of this function? _____
 - (c) Which of these correctly describes this relationship? (Circle one)

(i) $N = f(T)$	(ii) $y = f(x)$	(iii) $T = f(N)$	(iv) $N = f(x)$	(v) $N = 3T^2 + 4$
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 - (d) Give the domain of this function.



13) Use the graph to answer the following:



- (a) $f(-2) =$ (b) $f(5) =$ (c) $g(f(2)) =$
 (d) How many roots does $f(x)$ have and what are they?
 (e) What is the domain of $f(x)$?
 (f) Give all x -values for which $g(x) = 5$. $x =$
 (g) Circle the correct version of $g(x)$ as a translated version of $f(x)$.

$g(x) = f(x + 2) + 7$ $g(x) = f(x - 2) + 7$ $g(x) = f(2) + 7$ $g(x) = 2 + f(x) + 7$

(h) Find the average rate of change of $f(x)$ from $x_1 = -4$ to $x_2 = 2$

14)

- (a) Simplify to a single term. (b) Simplify to a single term. (c) Simplify to an integer.
 $\ln(ax) + \ln(b) =$ $\ln ax - \ln bx =$ $\log_3 405 - \log_3 5 =$
 (d) Simplify to a single term. (e) Simplify. (f) Simplify.
 $2\ln x - \ln x =$ $\ln e^{4x} =$ $e^{\ln 3x} =$
 (g) Simplify to positive exponents. (h) Simplify to positive exponents. (i) Simplify to positive exponents.
 $a^3 a^5 b^{-4} =$ $(2x^2)^3 =$ $\sqrt{x^9} =$

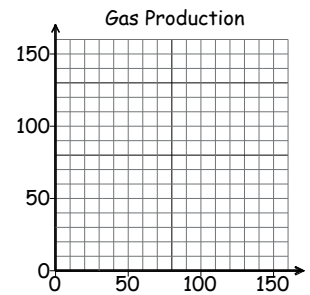
15) $f(x) = \sqrt{x-1}$ $g(x) = x^2 + 1$ Simplify the following:

- (a) $f(x+1) =$ (b) $g(x^{-1}) =$
 (c) $f(g(x)) =$ (d) $f^2(x) =$
 (e) $10 - 5g(x) =$ (f) $g(g(x))$

16) Find the inverse of $y = \frac{2}{x+1}$

17) $N(t) = 9.62te^{-0.035t}$ models natural gas production in a gas field ($t =$ days). $t = 0$ corresponds to the field coming on line.

- (a) Draw the graph of $N(t)$.
 (b) How many days after the field comes on line does the production peak?
 Round your answer to the nearest day.
 (c*) The investors stop production when it drops to 10. How many days is that?
 Round your answer to the nearest day.



An Oil Field supply is declining exponentially. Let $t =$ years with $t = 0$ being 2000. Supply is given in millions of barrels (bbl).

t	0	1	2	3	4	5
bbl	50	42	36	30	25	24

- (a) Run exponential regression on this data to determine the function which closely matches the data. Convert it to the form $y = Ae^{kt}$
 (b) What will the oil supply be in 2010 ($t = 10$)?
 (c) When will the oil supply drop to 1,000,000 bbl (bbl = 1 in above chart)?

You must show the solution process not merely the answer to receive full credit. Write in a neat and organized fashion. Circle or box-in your answers. Simplify and write exact values where possible. 100 pts.

- 1) Give the equation of the line through (2, -2) & (-13, 23)

4 pts

$$m = -5/3$$

$$b = 4/3$$

$$y = -\frac{5}{3}x + \frac{4}{3}$$

- 2) Solve for x using algebraic manipulation: $15 - 7\frac{x-1}{2} = \frac{x}{4} + 3$

5 pts

$$60 - 14x + 14 = x + 12$$

$$15x = 62$$

$$x = 62/15$$

- 3) Solve for x using algebraic manipulation: $(x-5)(x+2) = 4(3x+11)$

5 pts

$$x^2 - 3x - 10 = 12x + 44$$

$$x^2 - 15x - 54 = 0$$

$$x = -3, 18$$

$$(x-18)(x+3) = 0$$

- 4) Solve for y: $10 + \frac{5x-y}{3} = \frac{3y-2x+4}{5}$ LCD=15

5 pts

$$150 + 25x - 5y = 9y - 6x + 12$$

$$138 + 31x = 14y$$

$$y = \frac{31x + 138}{14}$$

- 5) Solve for y: $ax + by = 3x - 2y + 8$

5 pts

$$by + 2y = (b+2)y = 3x - ax + 8$$

$$y = \frac{3x - ax + 8}{b+2}$$

6) Solve for x: $4e^{ax+b} - 5 = 11$

4 pts

$$e^{ax+b} = 4$$
$$\ln e^{ax+b} = \ln 4$$

$$x = \frac{(\ln 4) - b}{a}$$

7) Solve for x: $\frac{\ln(ax+b)}{2} + 7 = 6$

4 pts

$$\ln(ax+b) = -2$$
$$e \quad e$$

$$x = \frac{e^{-2} - b}{a}$$

8) Solve using the TI: $e^{-x/2} = 2 + \ln x$. Give the answer with 4 significant digits.

2 pts

$$x \sim 0.3176$$

9*) An insect population was 600 on May 1. 5 days later the population had increased to 1,430.

Use $P(t) = P_0 e^{rt}$ with May 1 corresponding to $t = 0$. Determine r . 3 pts

$$1430 = 600 e^{5r}$$
$$r = \frac{\ln\left(\frac{1430}{600}\right)}{5} \sim 0.1737$$

10) $P(t) = P_0 e^{-kt}$ models radioactive decay. Suppose you start with 200 grams of radioactive Silicon (Si) with a half-life of 140 yrs.

(a) What is the value for P_0 ? 2 pts 200 gms

(b) How much Silicon will be left in 500 yrs? 2 pts

$$k = \frac{\ln 2}{140}$$
$$16.8 \text{ gms}$$

(c) How many years until the Silicon decays to 10 grams? 2 pts

$$10 = 200 e^{-kt}$$
$$605.1 \text{ yrs}$$

11) The mosquito population for Swamp Camp can be modeled by $M(t) = 500 t e^{-0.12t}$ Where $t = 0$ on June 1.

(a) What is the maximum mosquito population? Hint: Graph it. 2 pts

$$\sim 1533$$

(b) How many days until the mosquito population drops below 1 of the nasty little buggers? 2 pts

$$\sim 89 \text{ days}$$

pg 2

12) Function 'f' represents the number of bugs counted (N) at time of day (T) with time in minutes starting at midnight for the next 24 hrs. 4 pts



(a) Give the independent variable T = time of day minutes

(b*) What does $f(7) = 8$ mean in terms of this function? At 7am there were 8 bugs

(c) Which of these correctly describes this relationship? (Circle one)

- (i) $N = f(T)$ (ii) $y = f(x)$ (iii) $T = f(N)$ (iv) $N = f(x)$ (v) $N = 3T^2 + 4$

(d) Give the domain of this function. $t \in [0, 1440]$

13) Use the graph to answer the following: 1 pt each

(a) $f(-2) = -1$ (b) $f(5) = \phi$ (c) $g(f(2)) = g(2) = 8$

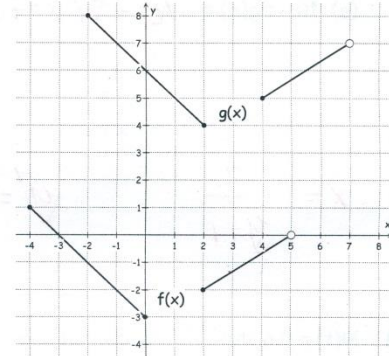
(d) How many roots does f(x) have and what are they?

1 @ $x = -3$

(e) What is the domain of f(x)?

$x \in [-4, 0] \cup [2, 5]$

(f) Give all x-values for which $g(x) = 5$. $x = 1, 4$



(g*) Circle the correct version of g(x) as a translated version of f(x).

$g(x) = f(x + 2) + 7$

$g(x) = f(x - 2) + 7$

$g(x) = f(2) + 7$

$g(x) = 2 + f(x) + 7$

(h) Find the average rate of change of f(x) from $x_1 = -4$ to $x_2 = 2$

$y_1 = f(-4) = 1$

$y_2 = f(2) = -2$

$m = -1/2$

14)

(a) Simplify to a single term.
 $\ln(ax) + \ln(b) =$

$\ln(abx)$

(b) Simplify to a single term.
 $\ln ax - \ln bx =$

$\ln(a/b)$

(c) Simplify to an integer. 2 pts each

$\log_3 405 - \log_3 5 =$ $\log_3 81 =$

4

(d) Simplify to a single term.
 $2\ln x - \ln x =$

$\ln x$

(e) Simplify.
 $\ln e^{4x} =$

$4x$

(f) Simplify.
 $e^{\ln 3x} =$

$3x$

(g) Simplify to positive exponents.
 $a^3 a^5 b^{-4} =$

a^8/b^4

(h) Simplify to positive exponents.
 $(2x^2)^3 =$

$2^3 x^6$

(i) Simplify to positive exponents.
 $\sqrt{x^9} =$

$x^{9/2}$

15) $f(x) = \sqrt{x-1}$ $g(x) = x^2 + 1$ Simplify the following: 3 pts each

(a) $f(x+1) = \sqrt{(x+1)-1} = \sqrt{x}$

(b) $g(x^{-1}) = x^{-2} + 1 = \frac{1}{x^2} + 1$

(c) $f(g(x)) = \sqrt{(x^2+1)-1} = x$

(d) $f^2(x) = \sqrt{x-1}^2 = x-1$

(e) $10 - 5g(x) = 10 - 5(x^2+1) = 5 - 5x^2$

16) Find the inverse of $y = \frac{2}{x+1}$ 5 pts

$x = \frac{2}{y+1}$ $y^{-1} = \frac{2}{x} - 1$ or $\frac{2-x}{x}$

17) $N(t) = 9.62te^{-0.035t}$ models natural gas production in a gas field (t = days).
 $t = 0$ corresponds to the field coming on line. 1 pt each

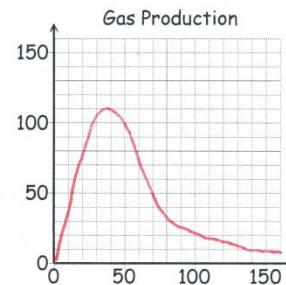
(a) Draw the graph of $N(t)$.

(b) How many days after the field comes on line does the production peak? Round your answer to the nearest day.

$28.6 \sim 29$ days

(c*) The investors stop production when it drops to 10. How many days is that? Round your answer to the nearest day.

~ 140 days



BONUS

An Oil Field supply is declining exponentially. Let t = years with $t = 0$ being 2000. Supply is given in millions of barrels (bbl). 2 pts each

t	0	1	2	3	4	5
bbl	50	42	36	30	25	24

(a) Run exponential regression on this data to determine the function which closely matches the data. Convert it to the form $y = Ae^{kt}$

$y = 48.99(0.857)^t \rightarrow y = 48.99e^{-0.1545t}$

(b) What will the oil supply be in 2010 ($t = 10$)? 10.45 Mbbl

(c) When will the oil supply drop to 1,000,000 bbl (bbl = 1 in above chart)?

~ 25.2 yrs