MAC 1105
Chapter 6
6.1 - 6.4
Practice for the Exam
SOLUTIONS

① $f(g(4)) = f(8) = \boxed{2}$

② $f(g(-3)) = f(1) = \boxed{2}$

③ $g(f(-1)) = g(0) = \boxed{4}$

④ $f(x) = |12x^2 - 2x|$
$g(x) = 18x - 8$
$f(g(9))$
$g(9) = 18(9) - 8 = 154$
$f(154) = |12(154)^2 - 2(154)|$
$= \boxed{284,284}$

⑤ $f(x) = 4x + 2$
$g(x) = 4x^2 + 1$
$f(f(3))$
$f(3) = 4(3) + 2 = 14$
$f(14) = 4(14) + 2 = \boxed{58}$

⑥ $f(x) = 7x + 8$
$g(x) = \frac{-2}{x}$
$(g \circ f)(3) = g(f(3))$
$f(3) = 7(3) + 8 = 29$
$g(29) = \boxed{\frac{-2}{29}}$

⑦ $f(x) = \frac{x-6}{10}$
$g(x) = 10x + 6$
$(g \circ f)(x) = g(f(x))$
$= g\left(\frac{x-6}{10}\right) = 10\left(\frac{x-6}{10}\right) + 6$
$= x - 6 + 6 = \boxed{x}$

⑧ $f(x) = \frac{x+4}{3}$
$g(x) = 3x - 4$
$f(g(x)) = f(3x - 4)$
$= \frac{(3x-4)+4}{3} = \frac{3x}{3} = \boxed{x}$
$g(f(x)) = g\left(\frac{x+4}{3}\right)$
$= 3\left(\frac{x+4}{3}\right) - 4 =$
$= x + 4 - 4 = \boxed{x}$
so f & g are inverse functions.

(9) $f(x) = 9x$

$g(x) = \frac{x}{9}$

$f(g(x)) = f\left(\frac{x}{9}\right) = 9\left(\frac{x}{9}\right) = \boxed{x}$

$g(f(x)) = g(9x) = \frac{9x}{9} = \boxed{x}$

so f & g are inverses.

(10) $P(x) = 2x^2 + 9$

$S(a) = 3a + 5$

$P(3a+5) = 2(3a+5)^2 + 9$

$= 2(9a^2 + 15a + 15a + 25) + 9$

$= 2(9a^2 + 30a + 25) + 9$

$= 18a^2 + 60a + 50 + 9$

$= \boxed{18a^2 + 60a + 59}$

(11) $f(x) = 4x + 4$

$g(x) = x + 5$

$f(g(x)) = f(x+5) = 4(x+5) + 4 = 4x + 20 + 4$

$= \boxed{4x + 29}$

no restrictions

no restrictions

so $\boxed{D: \mathbb{R}}$

(12) $f(x) = x + 4 \quad g(x) = \frac{9}{x+6}$

$f(g(x)) = f\left(\frac{9}{x+6}\right) = \boxed{\frac{9}{x+6} + 4}$

$x + 6 \neq 0$

$x \neq -6$

$x \neq -6$

$\boxed{D: \mathbb{R} \text{ except } -6}$

(13) $f(x) = \frac{-1}{x-7}$

$g(x) = \frac{-49}{x}$

$f(g(x)) = f\left(\frac{-49}{x}\right)$

so $\boxed{x \neq 0}$

$= \frac{-1}{\left(\frac{-49}{x}\right) - 7} \quad lcd = x$

$= \frac{-x}{-49 - 7x} = \frac{x}{49 + 7x}$

so $49 + 7x \neq 0$

$7x \neq -49$

$\boxed{x \neq -7}$

$\boxed{D: \mathbb{R} \text{ except } -7 \text{ & } 0}$

(14) $f(x) = 5x + 2$

$g(x) = \sqrt{x}$

$f(g(x)) = f(\sqrt{x}) = 5(\sqrt{x}) + 2$

$x \geq 0$ $\quad$ $x \geq 0$

so **D: $x \geq 0$**

(15) yes it is one to one

(no repeating x values → function)

(no repeating y values → one to one)

(16) no $\quad$ 10 → 2000

$15 → 2000

(17) 11 is repeated

(no)

(18) all x & y's are unique

(yes)

(19) function (VLT) yes

1 to 1 (HLT) yes

(20) function (VLT) yes

1 to 1 (HLT) no

(21) function (VLT) yes

1 to 1 (HLT) yes

(22) Inverse D: {3000, 4000, 7000, 11,000}

R: {5, 10, 15, 25}

(23) Inverse

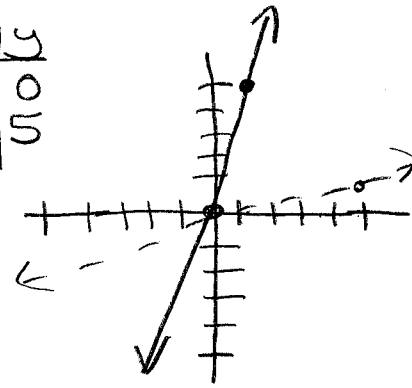
{(5, -4), (4, -5), (3, 6), (-3, -6)}

D: {-3, 3, 4, 5}

R: {-6, -5, -4, 6}

(24) $f(x) = 5x$

x	y
0	0
1	5



$f^{-1}(x)$

x	y
0	0
5	1

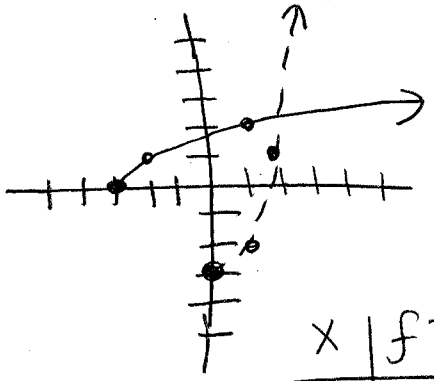
(25) $f(x) = \sqrt{x+3}$

(-3, 0)

up, R

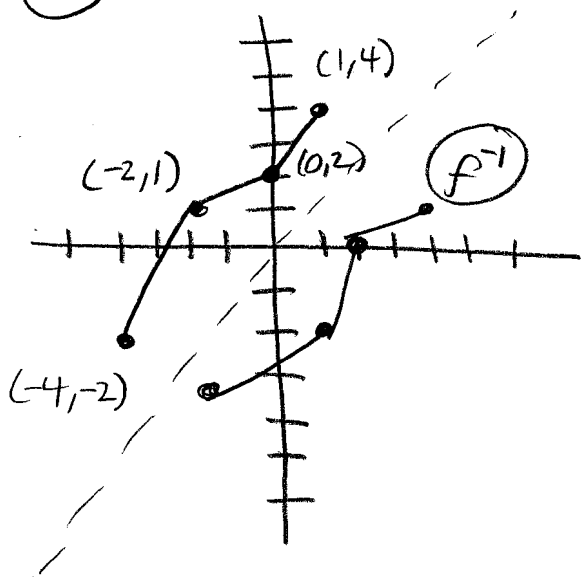
(+a) (+x)

x	f
-3	0
-2	1
1	$\sqrt{4} = 2$



x	f^{-1}
0	-3
1	-2
2	1

(26)



(4,1)
(1,-2)
(2,0)
(-2,-4)

(27) $f(x) = 9x - 9$

$g(x) = \frac{1}{9}x + 1$

$f(g(x)) = f\left(\frac{1}{9}x + 1\right)$

$= 9\left(\frac{1}{9}x + 1\right) - 9$

$= x + 9 - 9 = \boxed{x}$

$g(f(x)) = g(9x - 9)$

$= \frac{1}{9}(9x - 9) + 1$

$= x - 1 + 1 = \boxed{x}$

f & g are inverses since $f(g(x)) = x$ and $g(f(x)) = x$

(28) $f(x) = 7x - 9$

$g(x) = \frac{x+7}{9}$

$f(g(x)) = f\left(\frac{x+7}{9}\right)$

$= 7\left(\frac{x+7}{9}\right) - 9$

$= \frac{7}{9}x + \frac{49}{9} - 9 \neq \boxed{x}$

not inverses

(29) $f(x) = 5x - 3$

$y = 5x - 3$

$x = 5y - 3$

$x + 3 = 5y$

$\frac{x+3}{5} = y = f^{-1}(x)$

(30) $f(x) = \frac{8}{x}$

$y = \frac{8}{x}$

$x = \frac{8}{y}$

$y \cdot x = \frac{8}{y} \cdot y$

$y = \frac{8}{x} = f^{-1}(x)$

It is it's own inverse.

(31) $f(x) = x^3 - 1$

$y = x^3 - 1$

$x = y^3 - 1$

$x + 1 = y^3$

$\boxed{\sqrt[3]{x+1} = y = f^{-1}(x)}$

(32) $f(x) = \frac{4}{3x+5}$

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

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

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

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

$\boxed{y = \frac{4}{3x} - \frac{5}{3} = f^{-1}(x)}$

(33) $f(x) = -2^{x+3} + 4$

$-1 \cdot 2^{x+3} + 4$

start $-1(0,1) = (0,-1)$

shift $(-3,4)$

$(-3,3)$

HA: $y = 4$

(34) $f(x) = 5^{-x} + 4$

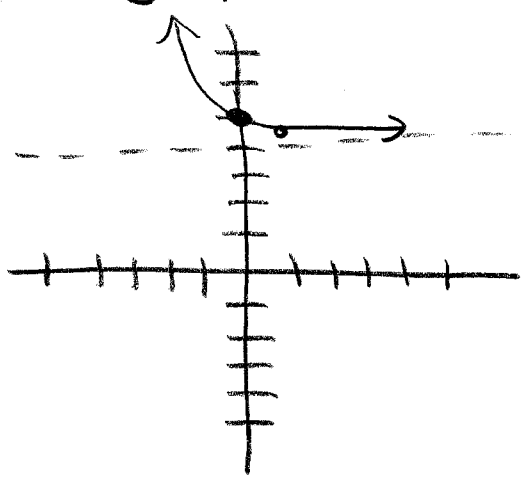
start $(0,1)$

shift $(0,4)$

$(0,5)$

x	y
0	5
1	$\frac{1}{5} + 4$
-1	$5^1 + 4 = 9$

HA: $y = 4$

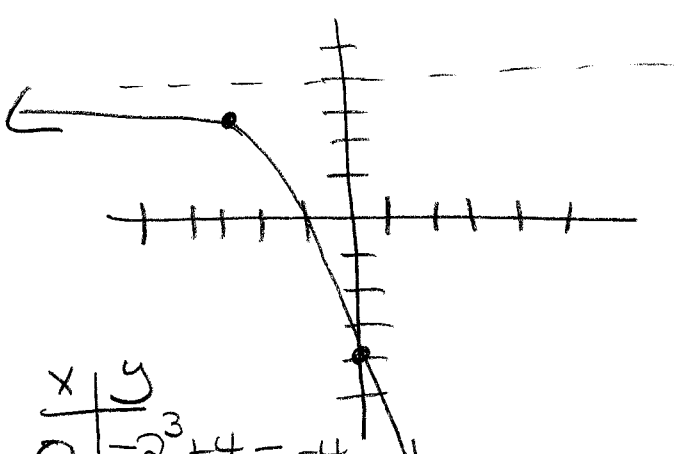


D: $\mathbb{R}$

R: $y \geq 4$

D: $\mathbb{R}$

R: $y \leq 4$



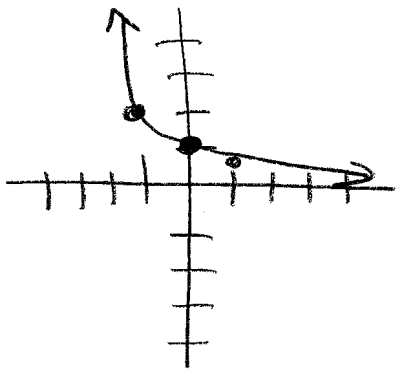
x	y
0	$-2^3 + 4 = -4$

(35) $f(x) = \left(\frac{1}{2}\right)^x = (2^{-1})^x = 2^{-x}$

D: $\mathbb{R}$
R: $y \geq 0$

start (0,1)
shift (0,0)
(0,1)

HA: $y = 0$



x	y
−1	$2^1 = 2$
0	1
1	$2^{-1} = \frac{1}{2}$

(36) $f(x) = \ln(2-x)$

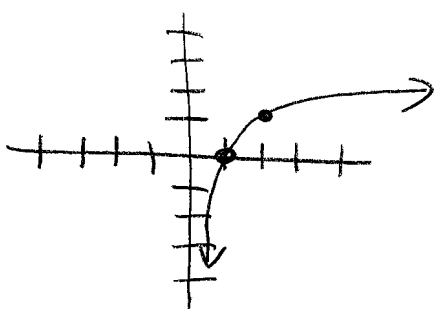
$2 - x > 0$
$2 > x$
so D: $x < 2$

(37) $f(x) = \log_2 x$

start (1,0)
shift (0,0)
(1,0)

D: $x > 0$
R: $\mathbb{R}$

VA: $x = 0$



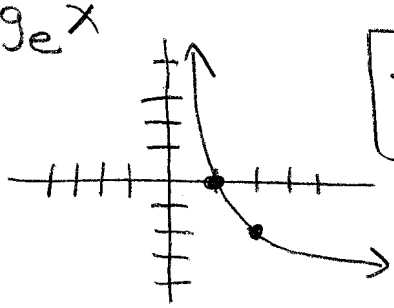
x	y
1	$\log_2 1 = 0$
2	$\log_2 2 = 1$

(38) $f(x) = -3\ln x = -3\log_e x$

start (1,0)
shift (0,0)
(1,0)

VA: $x = 0$

x	y
1	$-3(0) = 0$
2	-2.1



D: $x > 0$
R: $\mathbb{R}$

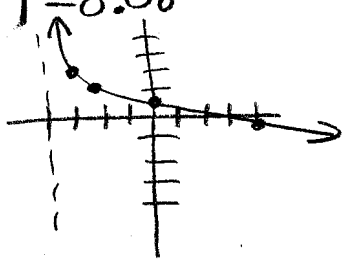
(39) $f(x) = -\ln(x+4) + 2$

start (1,0)
shift (−4,2)
(−3,2)

VA: $x = -4$

D: $x > -4$
R: $\mathbb{R}$

x	y
−3	2
−2	1.31
0	0.61
4	−0.08

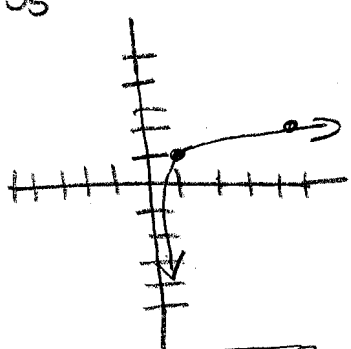


(40) $f(x) = \log_5 x + 1$

start (1,0)
shift (0,1)
(1,1)

VA: $x = 0$

x	y
1	1
5	$\log_5 5 + 1 = 2$



D: $x > 0$
R: $\mathbb{R}$