

MCR3U  
Chapter 3 Review Jan 2014

Name \_\_\_\_\_

1. A radioactive substance with an initial mass of 80 mg has a half-life of 2.5 days.

a) Write a function to relate the amount remaining,  $A$ , to the time,  $t$ , in days.

$$A = 80 \left(\frac{1}{2}\right)^{t/2.5}$$

b) What amount of the sample will remain after 15 days?

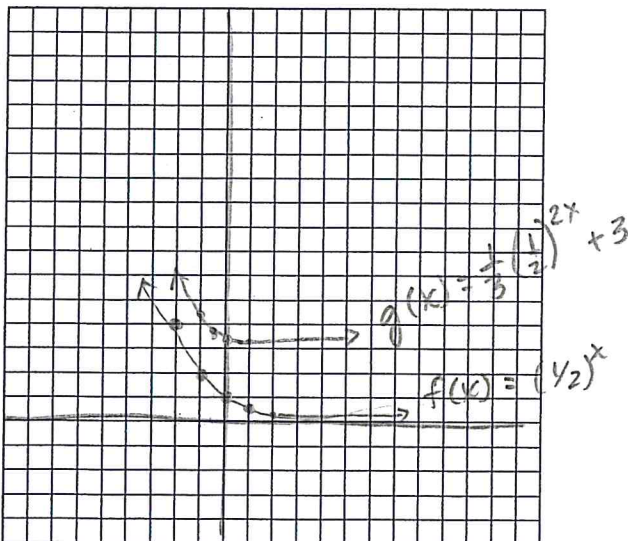
$$\begin{aligned} A &= 80 \left(\frac{1}{2}\right)^{\frac{15}{2.5}} \\ &= 80 \left(\frac{1}{2}\right)^6 \\ &= 1.25 \text{ mg} \end{aligned}$$

2. Certain transformations to the graph of the function  $f(x) = (1/2)^x$  will result in the graph of the transformed function  $g(x) = 1/3 (1/2)^{2x} + 3$ .

a) Describe each transformation.

b) State the domain, range and equation of the asymptote.

c) Sketch the graph of the new function and the original function on the same set of axes.



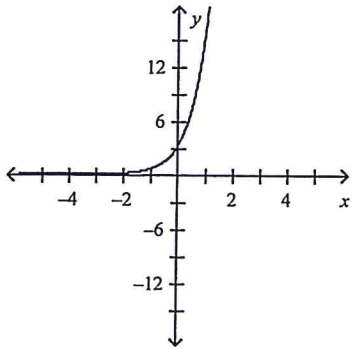
a) vert compression by a factor of  $1/3$   
horz. compression by a factor of  $1/2$   
up 3 units

b) D:  $\{x \in \mathbb{R}\}$   
R:  $\{y \in \mathbb{R} \mid y > 3\}$   
 $y = y$

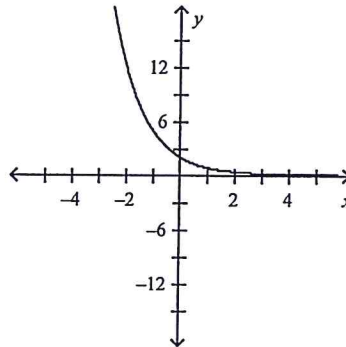
$\frac{x}{2}$	$x$	$y$	$\frac{1}{3}y + 3$
-1	-2	4	$\frac{4}{3} + 3 = 4.333$
-0.5	-1	2	$\frac{2}{3} + 3 = 3.666$
0	0	1	$\frac{1}{3} + 3 = 3.333$
0.5	1	0.5	$\frac{1}{6} + 3 = 3.1666$
1	2	0.25	$\frac{1}{12} + 3 = 3.0833$

3. Which graph represents the function  $y = 3\left(\frac{1}{5}\right)^x$ ?

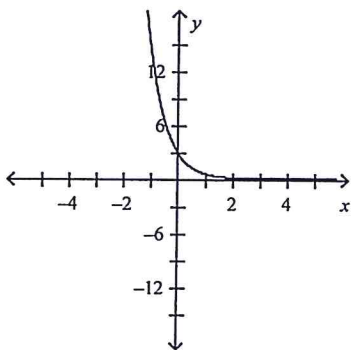
a.



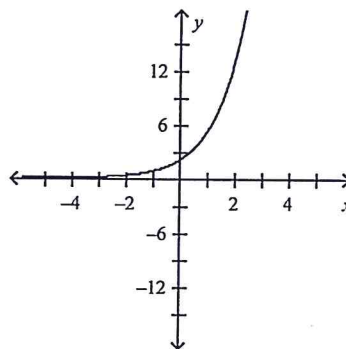
c.



b.



d.



4. Write the equation of the function that results from the transformation of the base function  $y = 2^x$ ,

- a) a vertical stretch of a factor of 3
- b) shift 1 unit down
- c) shift 6 units to the right

$$g(x) = 3(2)^{x-6} - 1$$

5. Evaluate: Do not use decimals!

a)  $5^{-2} = \frac{1}{5^2} = \frac{1}{25}$

b)  $-6^{-2} = -\frac{1}{6^2} = -\frac{1}{36}$

c)  $3^{-3} + 9^{-2} = \frac{1}{3^3} + \frac{1}{9^2} = \frac{1}{9} + \frac{1}{81} = \frac{9}{81} + \frac{1}{81} = \frac{10}{81}$

d)  $4^2(4^6)/4^5 = \frac{(4^2)(4^6)}{4^5} = 4^{2+6-5} = 4^3$

e)  $-(5/3)^{-4} = -\left(\frac{3}{5}\right)^4 = -\left(\frac{81}{625}\right) = -\frac{81}{625}$

f)  $(-4)^{-2} = \left(\frac{1}{-4^2}\right) = \frac{1}{16}$

g)  $(3/4)^{-3} = \left(\frac{4}{3}\right)^3 = \frac{64}{27}$

6. Simplify using only positive exponents:

a)  $a^{-4} \times a^8 = a^{-4+8} = a^4$

b)  $(4v^{-5})(-3v^{-2}) = -12v^{-5-2} = -12v^{-7} = \frac{-12}{v^7}$

c)  $a^6/a^4 = a^{6-4} = a^2$

d)  $(1/xy)^{-3} = \left(\frac{xy}{1}\right)^3 = x^3y^3$

→ e)  $(5m^2/2n^4)^{-3} = \left(\frac{2n^4}{5m^2}\right)^3 = \frac{8n^{12}}{125m^6}$

7. Express each power as a radical and then evaluate:

a)  $32^{3/5} = (\sqrt[5]{32})^3 = 2^3 = 8$

b)  $(-64)^{2/3} = (\sqrt[3]{-64})^2 = -4^2 = 16$

c)  $64^{5/6} = (\sqrt[6]{64})^5 = 2^5 = 32$

8. Write as a single power and then evaluate.

a)  $8^{1/3} \times 8^{2/3} = 8^{1/3 + 2/3} = 8^{3/3} = 8$

b)  $16^{1/4} \div 16^{1/2} \times 16^{3/4}$   
 $\frac{16^{1/4}}{16^{1/2}} \cdot 16^{3/4} = 16^{\frac{1}{4} - \frac{1}{2} + \frac{3}{4}} = 16^{\frac{2}{4}} = 16^{1/2}$   
 $= 16^{\frac{1}{4} - \frac{2}{4} + \frac{3}{4}} = \sqrt{16} = 4$

9. Simplify using only positive exponents:

a)  $(a^{1/2})(a^{2/3}) = a^{\frac{1}{2} + \frac{2}{3}} = a^{\frac{3}{6} + \frac{4}{6}} = a^{\frac{7}{6}}$

b)  $a^3 b^{1/2} \div a^{1/3} b^2 = \frac{a^3 b^{1/2}}{a^{1/3} b^2} = a^{3 - 1/3} b^{1/2 - 2} = a^{8/3} b^{-3/2} = \frac{a^{8/3}}{b^{3/2}}$

c)  $(z^{2/3})^{5/2} = z^{8/3}$

d)  $(w^{-6/11})^{-3/5} = w^{\frac{12}{33}}$

e)  $(16a)^{3/4} (265a)^{-1/4} = \frac{16^{3/4} a^{3/4}}{(265)^{1/4} a^{1/4}} = \frac{(\sqrt[4]{16})^3 a^{3/4}}{\sqrt[4]{265} a^{1/4}} = \frac{2^3 a^{3/4}}{4.03 a^{1/4}} = \frac{8 a^{3/4 - 1/4}}{4.03} = \frac{8 a^{1/2}}{4.03} = 1.99 a^{1/2}$

10. Simplify the expression  $\left(\frac{2u^3v^{-4}}{6u^{-4}v^{-3}}\right)^{-2}$ , showing all steps. Express your answer using only positive exponents.

$$\left(\frac{6u^{-4}v^{-3}}{2u^3v^{-4}}\right)^2 = \frac{36u^{-8}v^{-6}}{4u^6v^{-8}} = 9u^{-8-6}v^{-6+8}$$

$$= 9u^{-14}v^2$$

$$= \frac{9v^2}{u^{14}}$$

11. Simplify the expression  $\frac{\left(q^{-\frac{2}{3}}\right)\left(q^{\frac{1}{3}}\right)}{q^{\frac{4}{3}}}$ , showing all steps. Express your answer using only positive exponents.

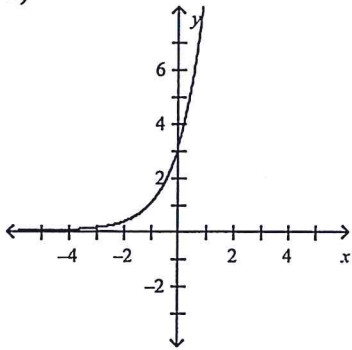
$$q^{-\frac{2}{3} + \frac{1}{3} - \frac{4}{3}}$$

$$q^{-\frac{5}{3}}$$

$$\frac{1}{q^{\frac{5}{3}}}$$

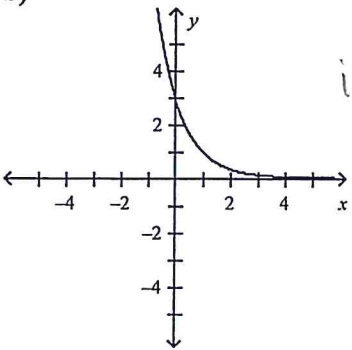
12. Match each graph with the correct corresponding equation.

a)



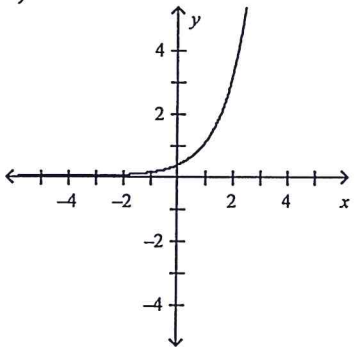
ii

b)



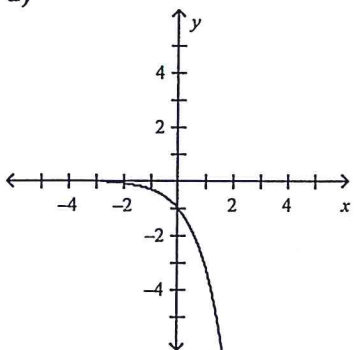
iv

c)



i

d)



iii

i)  $y = \frac{1}{3}(3)^x$  c

ii)  $y = 3(3)^x$  a

iii)  $y = -3^x$  d

iv)  $y = 3\left(\frac{1}{3}\right)^x$  b

13. Graph the function. Identify

i) domain

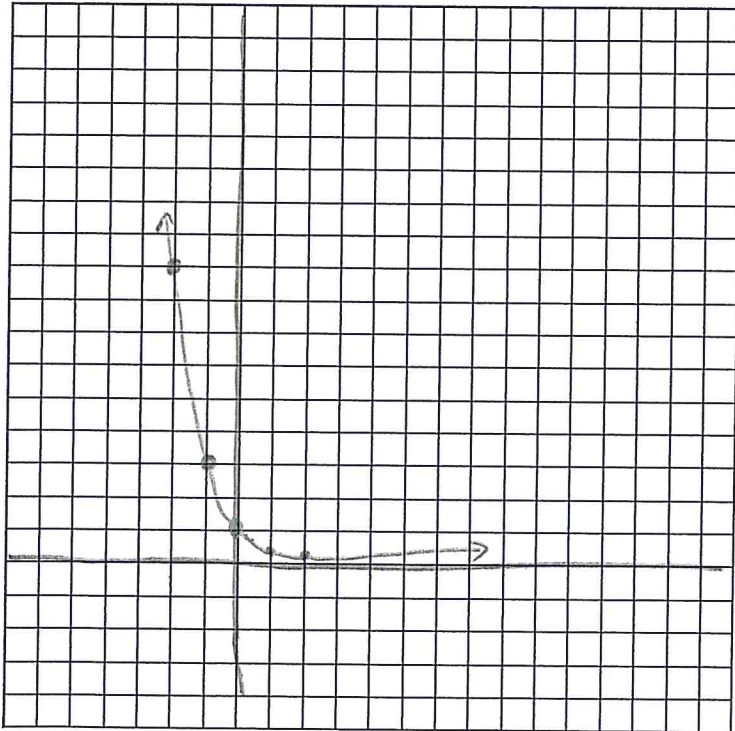
ii) range

iii) intercepts

iv) is it increasing/decreasing?

v) asymptote

a)  $f(x) = \left(\frac{1}{3}\right)^x$



x	y
-2	9
-1	3
0	1
1	1/3
2	1/9

$D: \{x \in \mathbb{R}\}$

$R: \{y \in \mathbb{R}, y > 0\}$

y inter. = 1

x inter. = none

decreasing

$y = 0$