

**List 0***Algebra review*

1. Which of the following are true for all real values of the variables (or, at least, all real values for which both sides of the equation are defined)?

(a)  $2x = x + x$   True

(b)  $2(x + y) = 2x + y$   False

(c)  $(x - y)^2 = x^2 - 2xy + y^2$   True

(d)  $\frac{6 + a}{2} = 3 + \frac{a}{2}$   True

(e)  $-(y + 2) = -y + 2$   False

(f)  $-(a + b)^2 = (-a + b)^2$   False

(g)  $x^3 + 3x = x + x$   False

(h)  $k^{-2} = \frac{1}{k^2}$   True

(i)  $x^{a+2} = x^a \times x^2$   True

(j)  $\sqrt{a + b} = \sqrt{a} + \sqrt{b}$   False

(k)  $\sqrt{a \cdot b} = \sqrt{a} \cdot \sqrt{b}$   True for non-negative numbers. If  $a < 0$  or  $b < 0$  or both, then this involves complex numbers, which are not part of this course.

(l)  $\log(a + b) = \log(a) + \log(b)$   False

(m)  $\log(a \cdot b) = \log(a) + \log(b)$   True for positive numbers.

(n)  $\log(a \cdot b) = \log(a) \cdot \log(b)$   False

2. Compute the following values:

(a)  $\cos(30^\circ) = \sqrt{3}/2$

(b)  $\cos(45^\circ) = 1/\sqrt{2}$  or  $\sqrt{2}/2$

(c)  $\cos(60^\circ) = 1/2$

(d)  $\cos(\pi/3) = 1/2$  (same as previous)

(e)  $\cos(\pi/2) = 0$

(f)  $\sin(8\pi/3) = \sqrt{3}/2$

(g)  $\sqrt{10000} = 100$

(h)  $10000^{1/2} = 100$  (same as previous)

(i)  $\sqrt[4]{10000} = 10$

(j)  $625^{-1/2} = 1/25$

(k)  $\log_7(49) = 2$

$$(\ell) \log_4(1024) = \boxed{5}$$

$$(m) \log_9(3) = \boxed{1/2}$$

$$(n) \log_k(1) = \boxed{0}$$

$$(o) \ln(1) = \boxed{0}$$

$$(p) \ln(\sqrt{e}) = \boxed{1/2}$$

$$(q) \log_4(16^3) = \boxed{6}$$

3. Re-write  $\frac{x^4}{\sqrt{x^{13}}}$  in the form  $x^\square$ .  $\boxed{x^{-5/2}}$  (That box is not a mistake in the file.)

4. Re-write each of the following in the form  $\square x^\square$ , or state that this is not possible. You can assume  $x > 0$  if necessary.

$$(a) x^3 \cdot x^7 = \boxed{x^{10}}$$

$$(b) x^3 x^7 = \boxed{x^{10}} \text{ (same as previous)}$$

$$(c) x^3 + x^7 \text{ not possible}$$

$$(d) x^3 - x^7 \text{ not possible}$$

$$(e) x^3/x^7 = \boxed{x^{-4}}$$

$$(f) \frac{x^3}{x^7} = \boxed{x^{-4}} \text{ (same as previous)}$$

$$(g) (x^3)^7 = \boxed{x^{21}}$$

$$(h) 3x^5 + (x^5)^2 \text{ not possible}$$

$$(i) 3x^{10} + (x^5)^2 = \boxed{4x^{10}}$$

$$(j) \sqrt{x^4} = \boxed{x^2}$$

$$(k) \sqrt{x^6 + x^4} \text{ not possible}$$

$$(l) \sqrt{x^6} + 8x^3 = \boxed{9x^3}$$

$$(m) x^3 \cdot \sqrt[3]{x} = \boxed{x^{10/3}}$$

$$(n) \ln(e^x) = \boxed{x}$$

$$(o) \ln(e^{6x}) = \boxed{6x}$$

$$(p) e^{9\ln(x)} = \boxed{x^9}$$

$$(q) e^{9\ln(x)+1} = \boxed{e x^9}$$

$$(r) e^{9\ln(x)} + 1 \text{ not possible}$$

$$(s) \frac{\sqrt{4e^{\ln(9x)+10}}}{e^5} = \boxed{6 x^{1/2}}$$

5. Re-write  $\log_{10}(2^9)$  using the natural logarithm ( $\ln$ ).  $\frac{\ln(512)}{\ln(10)}$  or  $\boxed{\frac{9 \ln(2)}{\ln(10)}}$

6. Expand each of the following:

(a)  $(a - b)^2 = a^2 - 2ab + b^2$

(b)  $(1 + x)^2 = 1 + 2x + x^2$

(c)  $(2 - x)^3 = 8 - 12x + 6x^2 - x^3$

(d)  $(6 + h)^3 = 216 + 108h + 18h^2 + h^3$

7. Simplify  $\frac{(6 + h)^3 - 216}{h}$  if  $h \neq 0$ .  $108 + 18h + h^2$

8. If a point on the line

$$y = -\frac{1}{3}(x - 6) + 8$$

has an  $x$ -value of 15, what is its  $y$ -value?  $5$

9. If a point on the line

$$y = -\frac{1}{3}(x - 6) + 8$$

has an  $x$ -value of 6, what is its  $y$ -value?  $8$

10. Graph each of the following:

(a)  $y = 3(x - 1) + 2$

(b)  $y = 3x - 1$

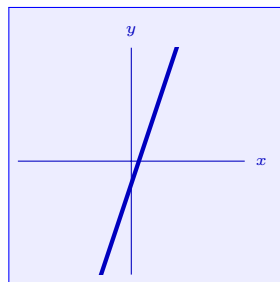
(c)  $y - 2 = 3(x - 1)$

(d)  $y + 1 = 3x$

(e)  $3x - y = 1$

(f)  $x = (y + 1)/3$

They are all the same!



11. Give an example of a point that is on the line

$$y - 17 = 38(x - 12).$$

There are literally infinitely many correct answers. The easiest to find is  $(12, 17)$  because those numbers occur in the equation in such a way that

$$17 - 17 = 38(12 - 12).$$

12. Describe the shape of  $y = 7$  in words.  $horizontal\ line$

Describe  $x = -2$  in words.  $vertical\ line$

13. Give an equation for the line through the point  $(-6, 5)$  with slope 2.

$y = 5 + 2(x + 6)$  or  $y = 2x + 17$

14. Give an equation for each of the following:

(a) the line through  $(1, 3)$  with slope 5.  $y = 3 + 5(x - 1)$  or  $y = 5x - 2$

(b) the line through  $(0, -9)$  with slope  $\frac{2}{5}$ .  $y = \frac{2}{5}x - 9$

(c) the line through  $(-4.2, 6.1)$  with slope 8.88.  $y = 6.1 + 8.88(x + 4.2)$   
or  $y = 8.88x + 43.396$

(d) the line through  $(5, 1)$  with slope  $-3$ .  $y = 1 - 3(x - 5)$  or  $y = -3x + 16$

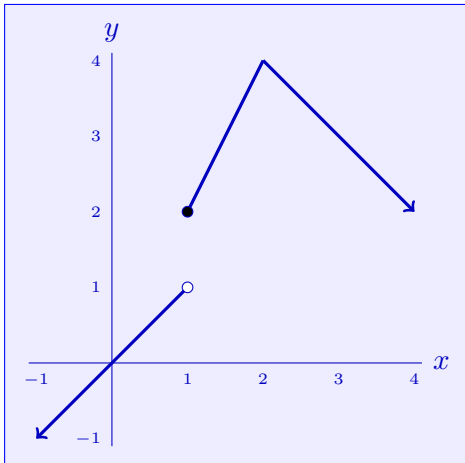
15. A line passes through both  $(4, 4)$  and  $(8, 2)$ . What is its slope?  $-1/2$

16. Give an equation for the line through  $(1, 7)$  and  $(10, -6)$ .

$y = 7 - \frac{13}{9}(x - 1)$  or  $y = -6 - \frac{13}{9}(x - 10)$  or  $y = -\frac{1}{3}x + \frac{76}{9}$

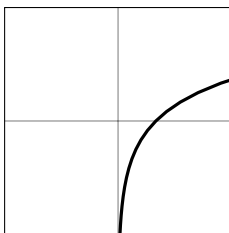
17. For  $f(x) = \begin{cases} x + 1 & \text{if } x < 4 \\ x^2 & \text{if } x \geq 4 \end{cases}$ , what is the value of  $f(4)$ ?  $4^2 = 16$

18. Draw a graph of the piecewise function  $\begin{cases} x & \text{if } x < 1 \\ 2x & \text{if } 1 \leq x \leq 2 \\ 6 - x & \text{if } x > 2 \end{cases}$ .

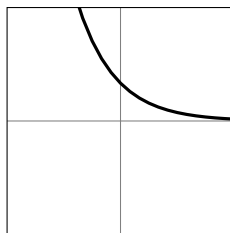


19. Match the functions with the graph:

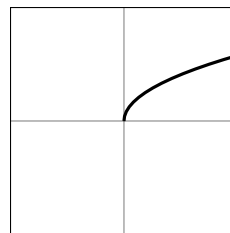
(a)  $e^x$  (IV)    (b)  $\sqrt{x}$  (III)    (c)  $\ln(x)$  (I)    (d)  $e^{-x}$  (II)



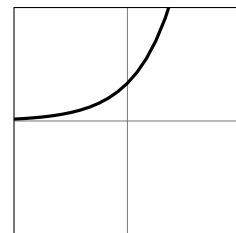
(I)



(II)



(III)



(IV)