

1. Simplify each expression. Your final answer must contain positive exponents only.

(a)  $\left(\frac{a^3b^2}{2a^{-3}b^5}\right)^2 \frac{a^4b}{\sqrt[3]{8}}$

(b)  $\sqrt[3]{24x^4y^6z^5}$

2. Find the exact value without using a calculator:

(a)  $(\sqrt{12} - 5\sqrt{3})^2$

(b)  $(-8)^{\frac{1}{3}} + 2(4)^{\frac{3}{2}} - 6(1)^{\frac{1}{3}}$

3. Rationalize the numerator:  $\frac{3 - \sqrt{25 - x^2}}{x + 4}$

4. Factor each polynomial completely:

(a)  $x^3 + x^2y - 9x - 9y$

(b)  $x^4 - 16$

(c)  $27x^3 + 8$

5. Perform the indicated operations and simplify the results:

(a)  $(2x - 5y)(4x^2 + 10xy + 25y^2)$

(b)  $\frac{5x^2 + 25x + 30}{x^2 + 6x + 9} \div \frac{x^2 - 4}{x + 3}$

(c)  $\frac{x + 1}{x^2 + 5x} - \frac{2x - 1}{2x^2 + 9x - 5}$

(d)  $\frac{\frac{x}{y} - \frac{y}{x}}{\frac{1}{y} - \frac{1}{x}}$

6. Use long division to find the quotient and the remainder of

$$\frac{3x^4 + x^3 - 8x^2 + 5x + 1}{x^2 + 2x}$$

7. Given the points P(-1,2) and Q(2,3), find the exact value of the following:

(a) the distance d between points P and Q

(b) the midpoint of the line segment joining P and Q

(c) the equation of the straight line  $L_1$  passing through P and Q

(d) the equation of the line  $L_2$  that is perpendicular to  $L_1$  and has y-intercept 2

(e) graph the line  $L_2$  of part (d).

8. Solve for x:

- (a)  $15 - x(6 - 2x) = 2x(x + 2)$
- (b)  $2x^2 = x + 6$
- (c)  $x^2 - 2x = 10$
- (d)  $\frac{x}{x^2 - 1} - \frac{1}{x^2 - x} = \frac{1}{x^2 + x}$
- (e)  $\sqrt{4x + 5} = x$
- (f)  $5(3 - 2x) \geq 2x + 21$
- (g)  $(10)^{4x} = (100)^{x - 1}$
- (h)  $e^{2x} = 3$
- (i)  $\log_2 x + \log_2(x + 5) = \log_2 6$

9. Given  $f(x) = x^2 + x$ , find and **simplify**  $\frac{f(x + h) - f(x)}{h}$

10. Find the **domain** and **range** of the function  $f(x) = \sqrt{1 - x}$ .

11. Given the function  $f(x) = x^2 - 4x + 3$ ,

- (a) use **completing the square method** to write it in the form  $f(x) = a(x - h)^2 + k$  and then state the following:
- (b) the vertex
- (c) the x- and y-intercept(s)
- (d) the equation of the axis of symmetry
- (e) the range
- (f) graph the function  $f(x)$ .

12. Graph the function,

$$g(x) = \begin{cases} -x + 3, & x < 1 \\ 3x - 1, & x \geq 1 \end{cases}$$

13. Given  $f(x) = \frac{4}{x}$  and  $g(x) = \frac{2}{3x - 5}$ , find the following:

- (a)  $(f/g)(x)$
- (b)  $f \circ g = f(g(x))$
- (c)  $g^{-1}(x)$

14. Given the function  $y = \frac{2x - 4}{x - 1}$ ,

- (a) state the domain and range, find the equations of the vertical and horizontal asymptotes and x and y-intercepts
- (b) draw the graph of the function.

15. Given  $y = -1 + 3^x$

- (a) find the equation of the asymptote
- (b) find the x and y-intercepts
- (c) state the range
- (d) sketch the graph of the function

16. If \$2000 is invested at 3% annual rate of interest, compounded monthly, what will the value of the invest be in 5 years? Round your answer to the nearest cent.
17. Find the value of the following to four decimal places:  
 (a)  $\ln 9$   
 (b)  $\log_6(12)$
18. Rewrite as a single logarithm:  $3 \ln(5) + \frac{1}{2} \ln y - 2 \ln x$
19. Rewrite as sum/difference of multiples of logarithms:  $\log_5 \frac{x(x+2)^4}{\sqrt[3]{x+3}}$
20. A kite is caught in the top branches of a tree. If the 25 meter kite string makes an angle of  $22^\circ$  with the ground, estimate the height of the tree by finding the distance from the kite to the ground.
21. Find the **complement** and **supplement** of  $75^\circ$  angle.
22. Convert:  
 (a)  $36^\circ$  to radian measure. Leave your answer in terms of  $\pi$   
 (b)  $-3\pi/5$  radians to degree measure
23. Draw a picture, state the reference angle and give the exact value for  
 (a)  $\sec(5\pi/3)$  (b)  $\cot(-210^\circ)$
24. If  $\theta$  is an angle in standard position whose terminal side contains the point (8,-6), find (a)  $\csc \theta$  (b)  $\cos \theta$
25. Given that  $\cos \theta = -2/3$  and  $\sin \theta < 0$ , find the exact value of  
 (a)  $\tan \theta$  (b)  $\sin \theta$
26. Find the exact value of the angle  $\theta$  in  $[0^\circ, 360^\circ)$  for which  $\sin \theta = \sqrt{3}/2$  and  $\theta$  is in QII.
27. Verify the following identities:  
 (a)  $\cos \theta (\sec \theta - \cos \theta) = \sin^2 \theta$  (b)  $\frac{1}{\tan \theta + \cot \theta} = \sin \theta \cos \theta$
28. State the amplitude and period, then graph two cycles of  $f(x) = -2 \sin (3 \pi x)$ .
29. In a triangle ABC, angle  $A=30^\circ$  and angle  $C=78^\circ$  while side  $a = 8$ . Find side  $c$ .
30. In a triangle ABC,  $a=7$ ,  $b = 9$ , and  $c = 6$ . Find angle C.
31. Two automobiles leave from the same point and travel along straight highways which differ in direction by  $82^\circ$ . If their speeds are 100 km/hour and 120 km/hour, how far apart will they be, to the nearest meter, an hour later?