

1. (4 points) Simplify the expressions. Answers should have only positive exponents and simplified radicals.

(a) $\left(\frac{(xy^2z^3)^2x^2y}{(zy^2)^3z^2}\right)^{-1}$

(b) $\sqrt[5]{32x^6y^{10}}$

2. (2 points) Rationalize the denominator. (Do not use decimals.)

$$\frac{3}{2\sqrt{2} - \sqrt{5}}$$

3. (2 points) Perform the long division.

$$\frac{x^4 + 64}{x^2 - 4x + 8}$$

4. (2 points) Rationalize the numerator and simplify.

$$\frac{\sqrt{3x} - \sqrt{3x + 3h}}{h\sqrt{3x}\sqrt{3x + 3h}}$$

5. (5 points) Factor completely.

(a) $x^3 - 2x^2 + 4x - 8$

(b) $54x^3y + 2y$

(c) $12x^2 + 4x - 5$

6. (6 points) Simplify each rational expression.

(a) $\frac{2x + 7}{x + 1} + \frac{3x - 5}{x + 2} - \frac{5x + 9}{x + 3}$

(b) $\frac{2x^2 + 3x + 1}{x^2 + x - 12} \cdot \frac{x^2 - x - 6}{x^2 - 1}$

7. (3 points) Simplify the complex fraction.

$$\frac{\frac{a}{2} + \frac{2}{a-2}}{\frac{a}{2} + \frac{2}{a+2}}$$

8. (7 points) Consider the points A(6, -6) and B(3, -1).

(a) Find the equation of the vertical line through B.

(b) Find the equation of the line passing through points A and B.

(c) Find the midpoint M of the line segment \overline{AB}

(d) Graph the lines from part(a) and part(b) and the point M.

(e) Find the distance between point A and point B.

9. (3 points) Consider the line L given by the equation $y = \frac{3}{4}x + 6$.

- (a) Find the x -intercept and y -intercept.
- (b) Find the equation of the line that passes through $(0, 0)$ and is parallel to L .
- (c) Find the equation of the line that passes through $(0, 3)$ and is perpendicular to L .

10. (1 point) Solve for x .

$$-8 - \frac{3}{4}x > 13$$

11. (12 points) Solve for x or state that there is no solution. Give exact answers.

- (a) $3x^2 - 5 = -x$
- (b) $x^3 - 4x = 0$
- (c) $\sqrt{x} - 7 = \sqrt{x + 7}$
- (d) $\frac{x}{x + 3} + \frac{2}{x - 3} = \frac{12}{x^2 - 9}$
- (e) $\log(x + 6) + \log(x - 3) = \log(6x)$
- (f) $3^{x^2+4} = 9^{2x}$

12. (6 points) Find the vertex, x - and y -intercepts, axis of symmetry, range, and domain of $y = -4x^2 - 12x - 5$ and sketch the graph.

13. (3 points) Find the domains of the following functions:

- (a) $f(x) = \frac{\sqrt{2x - 4}}{x - 3}$
- (b) $f(x) = \frac{\frac{x+4}{2x-8}}{x - 10}$

14. (2 points) Let $f(x) = \frac{2x+3}{x-1}$ and $g(x) = \sqrt{x-1}$.

- (a) Find $f(g(x))$ (do not simplify).
- (b) Find $f(f(x))$ (do not simplify).

15. (2 points) Find the inverse $f^{-1}(x)$ of the function $f(x) = \frac{5x - 7}{3x + 4}$

16. (3 points) Let $f(x) = \frac{1}{x + 3}$. Find and simplify $\frac{f(x + h) - f(x)}{h}$

17. (5 points) Let $y = \frac{15x + 3}{5x - 10}$.

- (a) Find its horizontal and vertical asymptotes.
- (b) Find its x - and y - intercepts.
- (c) Sketch its graph.

18. (2 points) Suppose \$2000 is invested at an annual interest rate of 7% compounded every 2 weeks. What is the value of the investment after 8 years (1 year = 52 weeks)? Round your answer in two decimal places.

19. (1 point) Calculate $\log_3(10)$ to at least 4 decimal places.

20. (4 points) Let $y = 2^x - 2$.

- (a) Find the asymptote.
- (b) Find its x - and y - intercepts.
- (c) Sketch its graph.

21. (2 points) Write the following expression as a single logarithm:

$$3 \log_5(x + 1) + 5 \log_5(x - 1) - \frac{1}{2} \log_5(x + 3)$$

22. (2 points) Write the following expression as sum/difference of multiples of logarithms:

$$\ln \left(\frac{x^3 \sqrt[3]{x+4}}{(2x-5)^{\frac{1}{4}}} \right)$$

23. (2 points) Convert between radians and degrees. Give exact answers.

- (a) 25°
- (b) $\frac{4\pi}{5}$

24. (1 point) Determine the complement and supplement of 110° , if possible.

25. (1 point) Calculate to at least 4 decimal places:

- (a) $\csc(125^\circ)$
- (b) $\tan\left(\frac{7\pi}{5}\right)$

26. (1 point) Without using a calculator, find the acute angle (between 0° and 90°) with $\cot \theta = \frac{1}{\sqrt{3}}$.

27. (2 points) If θ is an angle in standard position whose terminal side contains the point $(-5, 8)$, find $\cos \theta$. Give an exact answer.

28. (2 points) Find two angles between 0° and 360° with $\tan(\theta) = 4$. (Calculate to at least 2 decimal places).

29. (3 points) Prove the identities:

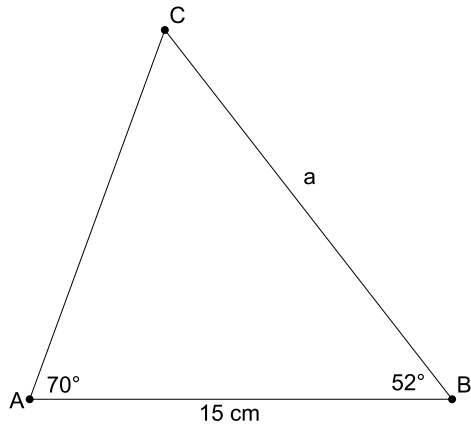
- (a) $\tan x \csc x = \sec x$
- (b) $\cot x + \tan x = \sec x \csc x$.

30. (2 points) A surveyor stands 300m along the ground away from the base of a tower. He determines that the angle of elevation from where he stands to the top of the tower is 18° . How tall is the tower?

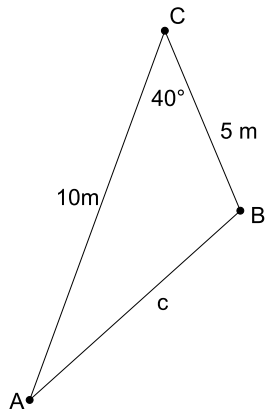
31. (3 points) Let $y = -2 \cos(3x)$.

- (a) Find the amplitude and period.
- (b) sketch at least 2 cycles of the function.

32. (2 points) In the triangle $\triangle ABC$, find the length a to 2 decimal places.



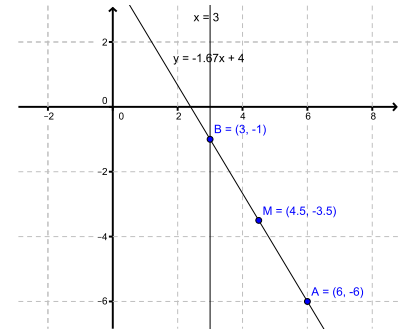
33. (2 points) In the triangle $\triangle ABC$, find the length c to 2 decimal places.



ANSWERS:

(1)a) $\frac{y}{x^4z}$ b) $2xy^2\sqrt[5]{x}$ (2) $2\sqrt{2} + \sqrt{5}$ (3) $x^2 + 4x + 8$ (4) $\frac{-1}{x\sqrt{3x+3h} + (x+h)\sqrt{3x}}$

(5)a) $(x^2 + 4)(x - 2)$ b) $2y(3x + 1)(9x^2 - 3x + 1)$ c) $(6x + 5)(2x - 1)$ (6)a) $\frac{-x + 9}{(x + 1)(x + 2)(x + 3)}$

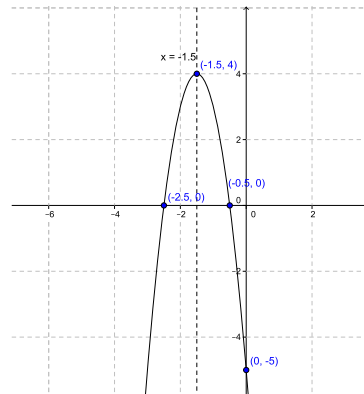


b) $\frac{(2x+1)(x+2)}{(x+4)(x-1)}$ (7) $\frac{a^3+8}{a^3-8}$ (8)a) $x = 3$ b) $y = \frac{-5}{3}x + 4$ c) $(4.5, -3.5)$ d)

e) $\sqrt{34}$ (9)a) x-int: $(-8, 0)$, y-int: $(0, 6)$ b) $y = \frac{3}{4}x$ c) $y = \frac{-4}{3}x + 3$ 10) $x < -28$

(11)a) $x = \frac{-1 \pm \sqrt{61}}{6}$ b) $x \in \{-2, 0, 2\}$ c) no solution d) $x = -2$ e) $x = 6$ f) $x = 2$

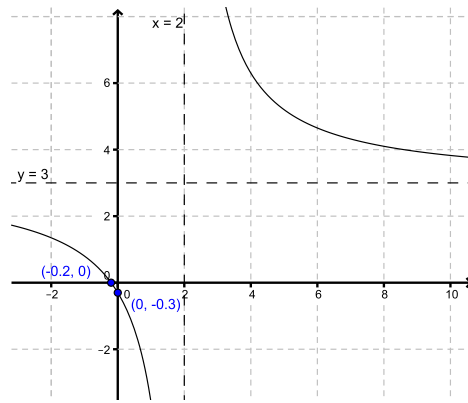
(12) vertex: $(-1.5, 4)$, axis of symmetry: $x = -1.5$, y-int: $(0, -5)$, x-int: $(-2.5, 0)$ and $(-0.5, 0)$,



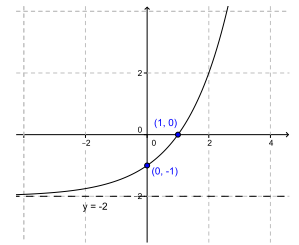
domain: $x \in (-\infty, \infty)$, range: $y \in (-\infty, 4]$

13)a) $x \in [2, 3) \cup (3, \infty)$ b) $x \in (-\infty, 4) \cup (4, 10) \cup (10, \infty)$ 14)a) $\frac{2(\sqrt{x-1})+3}{\sqrt{x-1}-1}$ b) $\frac{2(\frac{2x+3}{x-1})+3}{(\frac{2x+3}{x-1})-1}$

15) $f^{-1}(x) = \frac{-4x-7}{3x-5}$ (16) $\frac{-1}{(x+h+3)(x+3)}$ (17) a) vertical: $x = 2$, horizontal: $y = 3$ b) x-int:



$(-0.2, 0)$, y-int: $(0, -0.3)$ c)



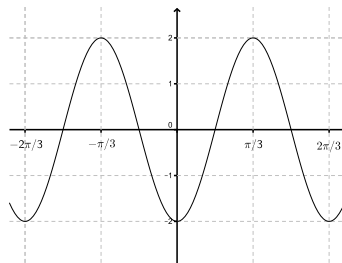
(18) \$3498.71 (19) 2.0959 (20)a) $y = -2$ b) x-int: $(1, 0)$, y-int: $(0, -1)$ c)

(21) $\log_5 \left(\frac{(x+1)^3(x-1)^5}{\sqrt{x+3}} \right)$ (22) $3 \ln(x) + \frac{1}{3} \ln(x+4) - \frac{1}{4} \ln(2x-5)$ (23)a) $\frac{5\pi}{36}$ b) 144° (24) no complement, supplement: 70°

(25)a) 1.2208 b) 3.0777 (26) 60° (27) $\frac{-5}{\sqrt{89}}$ (28) 75.96° and 255.96°

(29)a) $\tan(x) \csc(x) = \frac{\sin(x)}{\cos(x)} \frac{1}{\sin(x)} = \frac{1}{\cos(x)}$ and $\sec(x) = \frac{1}{\cos(x)}$

b) $\frac{\cos(x)}{\sin(x)} + \frac{\sin(x)}{\cos(x)} = \frac{\cos^2(x)}{\cos(x)\sin(x)} + \frac{\sin^2(x)}{\cos(x)\sin(x)} = \frac{\cos^2(x) + \sin^2(x)}{\cos(x)\sin(x)} = \frac{1}{\cos(x)\sin(x)}$
 and $\sec(x) \csc(x) = \frac{1}{\cos(x)} \frac{1}{\sin(x)}$



(30) 97.48m (31)a) $A = 2$ and $P = \frac{2\pi}{3}$ b)

(32) 16.62cm (33) 6.96m