Math 20-1 Functions and Equations

Multiple Choice Questions

1 $\sqrt{72}+\sqrt{18}$ simplifies to:

A. $9\sqrt{2}$
B. $3\sqrt{10}$
C. $\sqrt{90}$
D. $45\sqrt{2}$

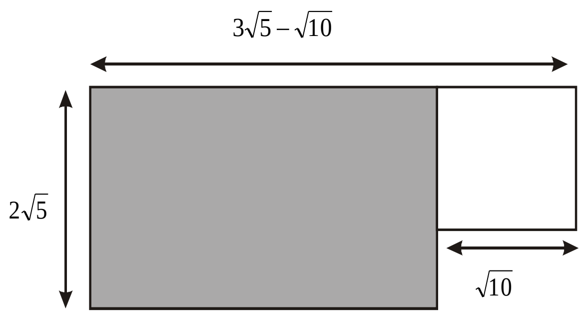
2 $(3\sqrt{x})(4\sqrt{x})$ simplifies to:

A. $12\sqrt{2x}$
B. $12x^2$
C. $12x^{1/4}$
D. $12x$

3 $\dfrac{3\sqrt{18}}{\sqrt{2}} \bullet \dfrac{3\sqrt{24}}{\sqrt{6}}$ simplifies to:

A. 9
B. 54
C. 3
D. 27

4 The area of the shaded region below is:



A. $5\sqrt{5}$
B. 30
C. $30-20\sqrt{2}$
D. $30-10\sqrt{2}$

5 When written as a mixed radical, $-3\sqrt{54}$ equals

A. $-\sqrt{162}$

B. $-\sqrt{486}$

C. $-27\sqrt{6}$

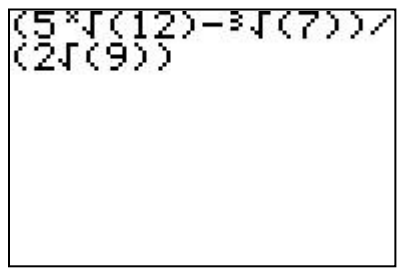
D. $-9\sqrt{6}$

6 The following problem involves the subtraction of radicals. In which step was the **first error** made?

Step	Question
	$\sqrt{50} - \sqrt{18} + \sqrt{12}$
1	$5\sqrt{2} - 3\sqrt{2} + 2\sqrt{3}$
2	$5\sqrt{2} - 3\sqrt{2} + 2\sqrt{3}$
3	$2\sqrt{2} + 2\sqrt{3}$
4	$4\sqrt{5}$

A. Step 1
B. Step 2
C. Step 3
D. Step 4

7 A student is working on a problem, and **correctly** enters it into her calculator. Her calculator entry is shown to the right. Which of the following accurately represents the problem she is attempting to evaluate?



A. $5\sqrt{12} - \dfrac{\sqrt[3]{7}}{\sqrt{9}}$

B. $\dfrac{5\sqrt{12} - \sqrt[3]{7}}{\sqrt{9}}$

C. $\sqrt[5]{12} - \dfrac{\sqrt[3]{7}}{2\sqrt{9}}$

D. $\dfrac{\sqrt[5]{12} - \sqrt[3]{7}}{2\sqrt{9}}$

8 Correct to the nearest tenth, the value of $\sqrt[3]{-27} + \sqrt{11}$ is

A. 0.3
B. 3.3
C. -6.3
D. -11.3

9 A rectangular room measures 2 m by 6 m. In one corner of the room is a door, and in the furthest opposite corner is a thermostat. Which of the following **most closely** represents the shortest walking distance between the door and the thermostat?

A. $4\sqrt{5}$

B. $2\sqrt{10}$

C. $8\sqrt{10}$

D. $8\sqrt{5}$

10 When simplified the value of $\sqrt{12} - 2\sqrt{27} + 2\sqrt{75}$ is

A. $6\sqrt{3}$

B. $7\sqrt{3}$

C. $-14\sqrt{3}$

D. $-3\sqrt{3}$

11 A student is asked to **rationalize the denominator** in the expression $\frac{3}{\sqrt{5}-1}$. Her answer is $\frac{3\sqrt{5}+3}{k}$. The value of k

A. 2
B. 4
C. 6
D. 8

12 When written as an entire radical, $2\sqrt{7}$ is equal to

A. $\sqrt{28}$

B. $\sqrt{14}$

C. $\sqrt{98}$

D. $\sqrt{49}$

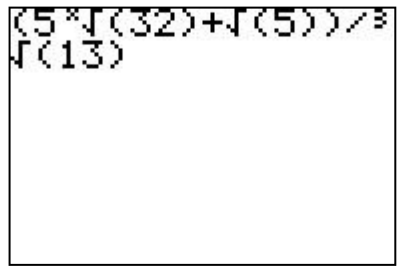
13 Jeff is working on 4 questions involving radicals. He is asked to respond to whether the statement in the question is true or false. His answers are in the chart below.

	Question	Jeff's Answer (true/false)
1	$\sqrt{49+64}=\sqrt{49}+\sqrt{64}=7+8=15$	true
2	$\dfrac{\sqrt{34}}{\sqrt{2}}=\sqrt{17}$	true
3	$\sqrt{15}\times\sqrt{6}=\sqrt{90}=9\sqrt{10}$	false
4	$\sqrt{25-9}=\sqrt{16}=4$	true

How many questions did Jeff answer correctly?

A. one
B. two
C. three
D. four

14 A student is working on a problem, and **correctly** enters it into her calculator. Her calculator entry is shown to the right. Which of the following accurately represents the problem she is attempting to evaluate?



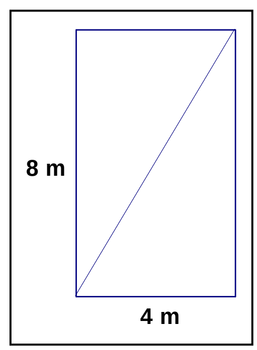
A. $5\sqrt{32}+\dfrac{\sqrt{5}}{3\sqrt{13}}$

B. $\dfrac{5\sqrt{32}+\sqrt{5}}{3\sqrt{13}}$

C. $\sqrt[5]{32}+\dfrac{\sqrt{5}}{\sqrt[3]{13}}$

D. $\dfrac{\sqrt[5]{32}+\sqrt{5}}{\sqrt[3]{13}}$

15 The dimensions of a rectangle are 8 m by 4 m, shown in the diagram on the right. The length of the diagonal can be calculated using the Pythagorean thereom; $a^2+b^2=c^2$. The **exact** value of the diagonal, shown by the dashed line is



A. $4\sqrt{3}$
B. $2\sqrt{3}$
C. $4\sqrt{5}$
D. $2\sqrt{5}$

16 When expanded and simplified as a mixed radical, the value of $\sqrt{3}\ \ \sqrt{12}+\sqrt{15}$ is

A. $\sqrt{15}+3\sqrt{2}$
B. $6+3\sqrt{5}$
C. $6+\sqrt{15}$
D. $\sqrt{81}$

17 Sylvia is rationalizing the denominator for the expression $\frac{\sqrt{3}+1}{\sqrt{3}-1}$. Her four step solution is shown below.

Step	
1	$=\frac{\sqrt{3}+1}{\sqrt{3}-1}\times\frac{\sqrt{3}+1}{\sqrt{3}+1}$
2	$=\frac{\sqrt{9}+\sqrt{3}+\sqrt{3}+1}{\sqrt{9}+\sqrt{3}-\sqrt{3}-1}$
3	$=\frac{3+\sqrt{6}+1}{3-1}$
4	$=\frac{4+\sqrt{6}}{2}$

Sylvia's **first error** was made in

A. Step 1
B. Step 2
C. Step 3
D. Step 4

18 The rational expression $\frac{(x+1)}{2(x-1)(4x+1)}$ has

A. one restriction on *x*.
B. two restrictions on *x*.
C. three restrictions on *x*.
D. four restrictions on *x*.

19 Which of the following is the **correct lowest common denominator** for the rational addition problem $\frac{3}{x+1}+\frac{5}{x^2-2x-3}$?

A. $(x+1)(x-3)$
B. $(x+1)^2(x-3)$
C. $(x+1)(x-1)(x+3)$
D. $(x+1)(x^2-2x-3)$

20 When simplified, $\frac{2x^2-2x}{x^2-1}$, $x\neq\pm1$ simplifies to

A. 2
B. $\frac{2x-1}{x+1}$
C. $\frac{2x}{x+1}$
D. $\frac{2x}{x-1}$

21 A student is working on the rational equation $\frac{2}{x+1}+\frac{4x}{x+1}=7$, $x \neq -1$. After multiplying both sides of this equation $(x+1)$, the equation that will need to be solved is

A. $2+4x=7$.
B. $2+4x=7x+7$.
C. $2x+2+4x^2+4x=7$.
D. $2x+2+4x^2+4x=7x+7$.

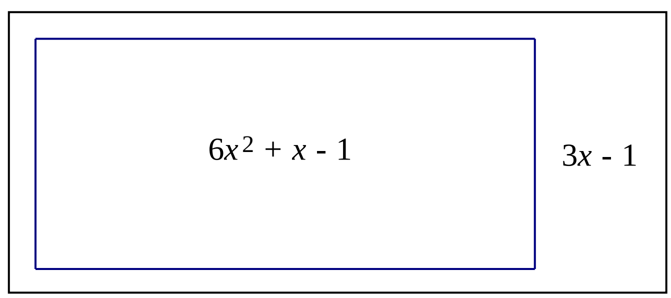
22 Peter drives during the day travelling 400 km for *t* hours. On the same journey, Peter's father drives at night also travelling 400 km for 1 hour longer and 10 km/h slower than Peter. Which of the following equations finds the velocity, *v*, that Peter drove?

A. $\frac{400}{v}=\frac{400}{v-10}-1$
B. $\frac{v}{400}=\frac{v-10}{400}-1$
C. $\frac{400}{v-10}=\frac{400}{v}-1$
D. $\frac{v-10}{400}=\frac{v}{400}-1$

23 In solving the equation $\frac{x+3}{2}-\frac{x-1}{4}=9$, a student should conclude that

A. There are **no** non-permissible values.
B. There are **two** non-permissible values.
C. There are **three** non-permissible values.
D. There are **four** non-permissible values.

24 The area and side width of a rectangle are given. In order to find the side length of this triangle, a student could



A. Simplify the expression $\frac{3x-1}{6x^2+x-1}$ to determine a side length of $6x+1$
B. Simplify the expression $\frac{6x^2+x-1}{3x-1}$ to determine a side length of $6x+1$
C. Simplify the expression $\frac{3x-1}{6x^2+x-1}$ to determine a side length of $2x+1$
D. Simplify the expression $\frac{6x^2+x-1}{3x-1}$ to determine a side length of $2x+1$

25 When simplified, the expression $\left(\frac{2pq^2}{4p^2}\right) \div \left(\frac{p}{8p^2q}\right)$, $p,q \neq 0$ equals

A. $\frac{q}{16p^2}$

B. $\frac{16p^2}{q}$

C. $4q^3$

D. $\frac{1}{4q^3}$

26 The sum of $\frac{3}{2x} + \frac{5}{x-2}$, $x \neq 0, 2$ is

A. $\frac{8}{2x(x-2)}$

B. $\frac{13x-2}{2x(x-2)}$

C. $\frac{8x-10}{2x(x-2)}$

D. $\frac{13x-6}{2x(x-2)}$

27 The simplified expression $\frac{16-x^2}{x-4}$ equals

A. $-x+4$
B. $x+4$
C. $-x-4$
D. $x-4$

28 The restrictions on the rational expression $\frac{x^2+x}{x(2x-1)}$ are

A. $x \neq \frac{1}{2}, 0$

B. $x \neq \frac{-1}{2}, 0$

C. $x \neq \frac{1}{2}$ only

D. $x \neq \frac{-1}{2}$ only

29 A student is completing the addition problem $\frac{x}{x^2+x}-\frac{2}{x+1}$. Which of the following is the student's **lowest common denominator**?

A. $(x^2+x)(x+1)$
B. $x(x+1)^2$
C. $x(x+1)$
D. $x^2(x+1)$

30 The expression $\frac{x^2+x-2}{x^2+3x-4}$, $x \neq 1, -4$ simplifies to

A. $\frac{x-1}{x+4}$
B. $\frac{x+2}{x-4}$
C. $\frac{x+1}{x+4}$
D. $\frac{x+2}{x+4}$

31 Rachel is working on the radical equation $\frac{x}{2}+\frac{2}{x-4}=1$. Which of the following should be her first step?

A. Multiply all the terms on the **left side** by $2(x-4)$.
B. Multiply all the terms on the **right side** by $2(x-4)$.
C. Multiply all the terms on **both sides** by $2(x-4)$.
D. Multiply all the terms on **both sides** by $2(x+4)$.

32 Two cars are travelling from Airville to Broadtown. Car A travels at 120 km/h for *t* hours. Car B travels at 100 km/h for 2 hours longer. Which of the following equations could be used to solve for the distance between Airville and Broadtown?

A. $\frac{d}{100}=\frac{d}{120}-2$
B. $\frac{d}{120}=\frac{d}{100}-2$
C. $\frac{d}{100}=\frac{d}{120}+2$
D. $\frac{d}{120}=\frac{d}{100}+2$

33 In solving the equation $2(x+1)(x-3)=2(x+1)(x+2)$, a student should conclude that

A. There are **no** non-permissible values.
B. There is **one** non-permissible value.
C. There are **two** non-permissible values.
D. There are **three** non-permissible values.

34 The area of a rectangle is $x^2+3x-10$. If it has a side length of $2x-4$ then the width can be represented by the expression

A. $\dfrac{x-5}{2}$

B. $\dfrac{2}{x-5}$

C. $\dfrac{x+5}{2}$

D. $\dfrac{2}{x+5}$

35 When simplified, the expression $\left(\dfrac{4a^2b^3}{2c^4}\right)\times\left(\dfrac{8c}{ab}\right)$, $a,c,b\neq 0$ equals

A. $\dfrac{16c^3}{ab^2}$

B. $\dfrac{c^3}{16ab^2}$

C. $\dfrac{ab^2}{16c^3}$

D. $\dfrac{16ab^2}{c^3}$

36 When divided and simplified, $\dfrac{8m^3}{3n^2}\div\dfrac{5m^2}{6n}$, $m,n\neq 0$, equals

A. $\dfrac{20m^5}{9n^3}$

B. $\dfrac{16m}{5n}$

C. $\dfrac{11m}{5n}$

D. $\dfrac{48m^3n}{15m^2n^2}$

37 The simplified expression $\dfrac{2x}{2}+\dfrac{x}{3}$ equals

A. $\dfrac{4x}{3}$

B. $\dfrac{3x}{5}$

C. $\dfrac{x^2}{3}$

D. $\dfrac{2x}{3}$

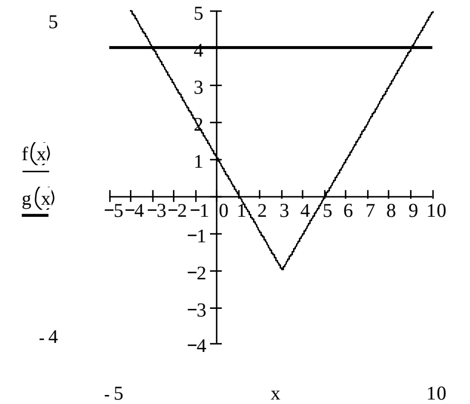
38 A student entered two functions in their calculator; $Y_1 = |x-3|-2$ and $Y_2 = 4$. The result is shown in the graph to the right. The *intersection points* of the two graphs are the solution to the equality;

A. $|x-3|-2=0$

B. $|x-3|-2=4$

C. $|x-3|-2=-4$

D. $|x-3|-2=1; |x-3|-2=5$



39 In solving the equality $\frac{1}{k+4} - \frac{2}{k^2+3k-4} = \frac{1}{k-1}$, the result is;

A. $k=-2$

B. $k=-1,2$

C. $k=-2,1$

D. No solution

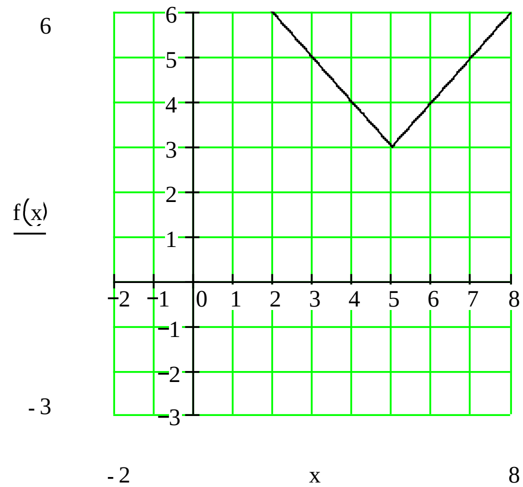
40 The graph to the right is of the function $f(x)$. According to the graph,

A. $f(x)=4$ has no solutions

B. $f(x)=4$ has one solution

C. $f(x)=4$ has two solutions

D. $f(x)=4$ has three solutions



41 A quadratic equation that could be derived in the attempt to solve $\frac{2x}{x+1} + \frac{3}{x-2} = 1$ is;

A. $x^2+5=0$

B. $2x^2-x+2=0$

C. $x^2-2x+1=0$

D. $2x^2-4x+5=0$

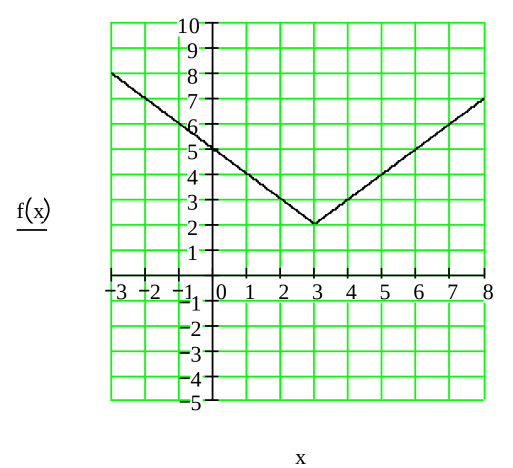
42 A student graphs the function $f(x)$, which is shown to the right. The *largest* solution to the equation $f(x)=4$ appears to be;

A. 1

B. 3

C. 5

D. 7



43 A student is attempting to solve the quadratic equation $\frac{2x}{x+1}+\frac{3}{x-2}=1$. Her steps are shown in the table below;

Step 1	$2x(x-2)+3(x+1)=1$
Step 2	$2x-4+3x+3=1$
Step 3	$5x-1=1$
Step 4	$5x=2$
Solution	$x=\frac{2}{5}$

The student made her *first error* in;

A. Step 1
B. Step 2
C. Step 3
D. Step 4

44 The reciprocal function $\frac{1}{f(x)}$ has a vertical asymptote at $x=-5$. Which of the following ordered pairs *must be* on $f(x)$?

A. (0, 5)
B. (0, -5)
C. (5, 0)
D. (-5, 0)

45 Randy travels the 240 km from Airdrie to Edmonton driving 120 km/h for 2 hours. His parents *strongly* suggest he slow down by v km/h, even though it will take him t hours longer to make the trip, or he will lose his driving privileges. Which of the following relations shows the time, t, it will now take Randy to make the trip relative to the speed, v with which he slows down?

A. $t=\frac{240}{120+v}-2$
B. $t=\frac{240}{120-v}+2$
C. $t=\frac{240}{120+v}+2$
D. $t=\frac{240}{120-v}-2$

46 The factored form of $f(x)$ is represented by the function $f(x)=k(x+1)^2(x-2)$, $k\in R$. Which of the following correctly describes the graph of the function $\frac{1}{f(x)}$?

A. $\frac{1}{f(x)}$ will have three asymptotes at $x=k,1,-2$

B. $\frac{1}{f(x)}$ will have three asymptotes at $x=-k,-1,2$

C. $\frac{1}{f(x)}$ will have two asymptotes at $x=1,-2$

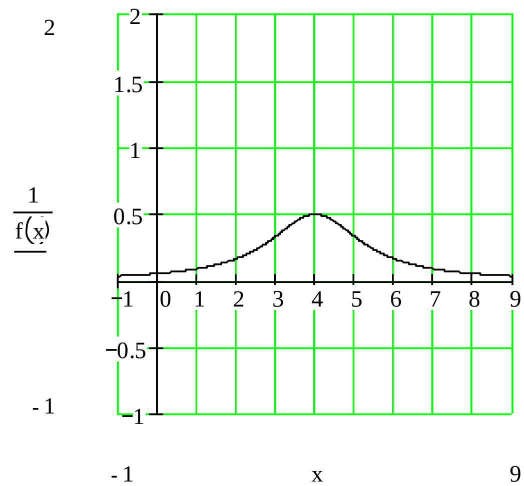
D. $\frac{1}{f(x)}$ will have two asymptotes at $x=-1,2$

47 The rational function is given by $m=\frac{48}{24-n}-2$. When $m=10$, the value of n must be;

A. 2
B. 10
C. 20
D. 40

48 The function $\frac{1}{f(x)}$ is shown in the graph to the right. If $f(x)$ is a quadratic function, which of the following statements would be true about the graph of $f(x)$?

A. $f(x)$ opens up with *no* x-intercepts
B. $f(x)$ opens down with *no* x-intercepts
C. $f(x)$ opens up with *one* x-intercept
D. $f(x)$ opens down with *one* x-intercept



49 A *cubic* function, $f(x)$, has three unique zeros. The reciprocal function $\frac{1}{f(x)}$ must have;

A. At least one, and not more than six invariant points with $f(x)$
B. At least two, and not more than six invariant points with $f(x)$
C. At least one, and not more than four invariant points with $f(x)$
D. At least two, and not more than four invariant points with $f(x)$

50 Geoff must travel 100 km. He correctly determines that travelling 50 km/h for 2 hours will cover that distance, but if he decreases his speed by v km/h, his time will increase by t hours. A function that correctly determines the change, v, in speed, relative to the time t in hours is $100 = (50 - v)(2 + t)$. When written as v in terms of t, this function is;

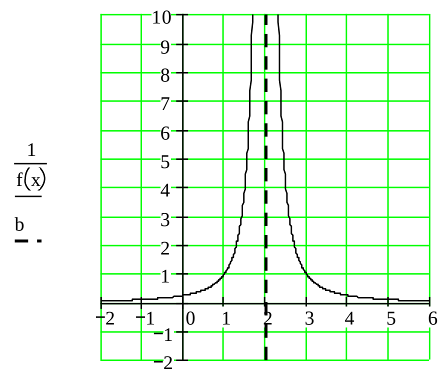
A. $v = 50 + \dfrac{100}{2+t}$, $t \neq -2$

B. $v = 50 - \dfrac{100}{2+t}$, $t \neq -2$

C. $v = 50 + \dfrac{100}{2-t}$, $t \neq 2$

D. $v = 50 - \dfrac{100}{2-t}$, $t \neq 2$

51 The function $\dfrac{1}{f(x)}$ is shown in the graph to the right. There are *no other* asymptotes. If $f(x)$ is a quadratic function, which of the following statements would be true about the graph of $f(x)$?



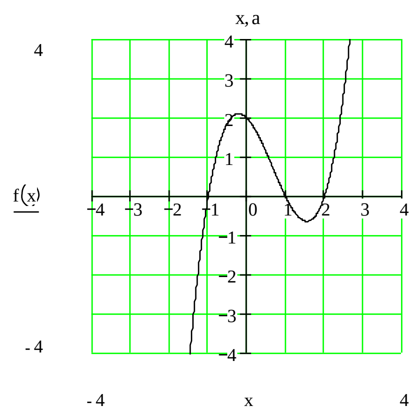
A. $f(x)$ opens up with *no* x-intercepts

B. $f(x)$ opens down with *no* x-intercepts

C. $f(x)$ opens up with *one* x-intercept

D. $f(x)$ opens down with *one* x-intercept

52 The function shown to the right is of $f(x)$. How many ordered pairs will $f(x)$ *share* with $\dfrac{1}{f(x)}$?



A. 4
B. 3
C. 2
D. 1

53 The function $y = f(x)$ is such that $f(x) < 0$ when $-2 < x < 1$. Which of the following is true regarding the function $y = |f(x)|$?

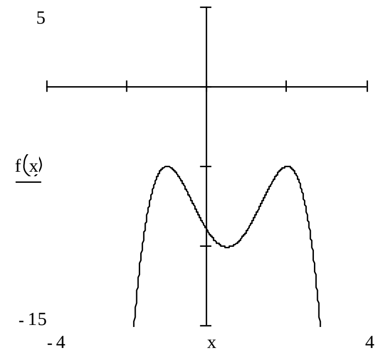
A. $|f(x)| > 0$ when $-2 < x < 1$

B. $|f(x)| < 0$ when $-2 < x < 1$

C. $|f(x)| > 0$ when $-1 < x < 2$

D. $|f(x)| < 0$ when $-1 < x < 2$

54 The graph of $y = f(x)$ is shown to the right. Which of the following could be said about $y = |f(x)|$?



A. $y = |f(x)|$ is a complete reflection of $y = f(x)$ around the y-axis.
B. $y = |f(x)|$ is a complete reflection of $y = f(x)$ around the x-axis.
C. $y = |f(x)|$ is a partial reflection of $y = f(x)$ around the y-axis.
D. $y = |f(x)|$ is a partial reflection of $y = f(x)$ around the x-axis

55 In graphing the function $g(x) = \dfrac{1}{f(x)}$, it is discovered that $g(x)$ has the domain $x \in R$. Which of the following could be said about the graph of $f(x)$?
A. $f(x)$ has no y-intercepts
B. $f(x)$ has no x-intercepts
C. $f(x)$ *cannot be* a function
D. $f(x)$ *cannot* share any ordered pairs with $g(x)$.

Numerical Response

1 Expressed as a mixed radical, $\sqrt{40}$ would have a coefficient of ________________.

2 In the radical expression $7\sqrt{11}$, the index number is ________________.

3 Expressed as an entire radical $5\sqrt{3}$ would have a radicand of ________________.

4 *Correct to the nearest tenth*, the value of $5\sqrt[4]{10}$ is _____.

5 If $\sqrt[3]{2000} = k\sqrt[3]{2}$, then the value of k must be _____.

6 If $\sqrt{288} = k\sqrt{2}$, then the value of k must be _____.

7 The expression $\dfrac{x}{2} + \dfrac{10}{x+2}$ is simplified yielding $\dfrac{x^2 + 2x + k}{2(x+2)}$. The value of k must be _____.

8 The **only** non-permissible value in the expression $\dfrac{x}{4x^2 - 4x + 1}$ is _____.

9 The chart below provides four factorable expressions.

Expression #1	$2x^2+x-1$
Expression #2	$2x^2+3x-2$
Expression #3	x^2-1
Expression #4	x^2+x

When two of those expressions are divided and simplified, the result is $\frac{2x-1}{x-1}$. This is **true** because expression ______ is **divided by** expression ______.

10 **Correct to the nearest hundredth**, the solution to the equation $\frac{2}{x}+\frac{5}{x}=9,\ x\neq 0$ is ______.

11 The equation $|2x-1|+5=9$ has two solutions. The only *positive solution* to this equation, *correct to the nearest tenth*, is ______.

12 When simplified, the value of $-\frac{12x-12}{1-x}$ is _____.

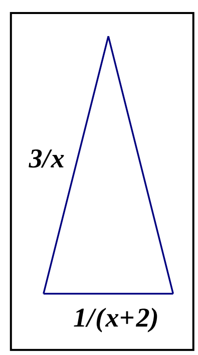
13 The solution for $\frac{x}{24}=\frac{1}{2}$ is ______.

14 The **largest** non-permissible value in the expression $\frac{3x+6}{x^2-8x-20}$ is ______.

15 The expression $\dfrac{\frac{3n+6}{2n+2}}{\frac{n+2}{n^2-1}}$, $n\neq \pm 1,-2$ simplifies to $\frac{a(n-1)}{b}$. The values of *a* and *b* are ______ (place your value for *a* in the first available box, and your value for *b* in the next available box).

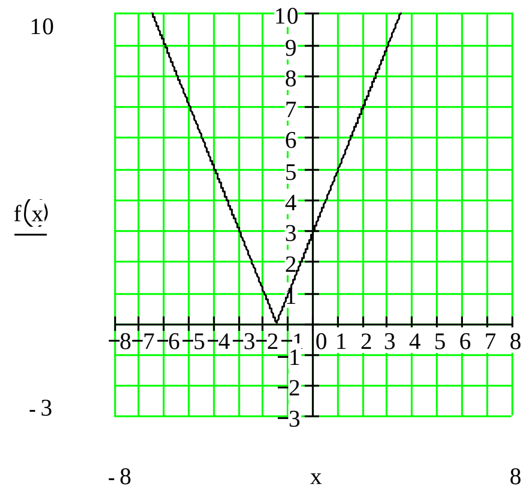
16 The rational expression $\frac{x^2+9x+k}{x^2+5x-6}$, $k\neq 1,-6$ simplifies to $\frac{x+3}{x-1}$ because *k* equals ______.

17 The perimeter of the isosceles triangle shown in the diagram on the right could be written $\frac{7x+m}{x(x+2)}$. The value of *m* must be ______ units.



18 **Correct to the nearest tenth**, the solution to the radical equation $2\sqrt{2x-1}-8=0$ is ______.

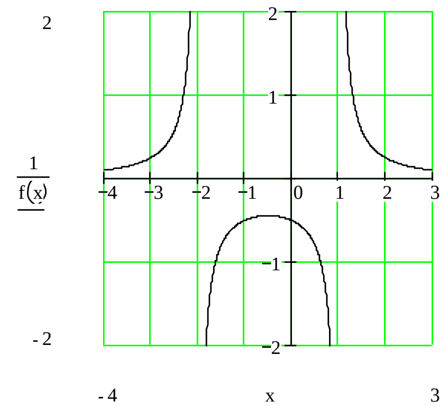
19 The graph shown to the right is of $f(x)$. The *largest solution* to the expression $f(x)=7$ appears to be _____.



20 A student is determining the solution to the equation $|x-2|+|3x-2|=6$ graphically. The student correctly determines two solutions. If one solution is $x=-0.5$, **correct to the nearest tenth**, the other solution must be $x=$_____.

21 The radical equation $2\sqrt{x+1}-k=0$, $k>0$, has one solution of $x=8$ if k equals _____.

22 The *largest restriction* on x in the solution to the equation $\dfrac{2x}{x^2-2x-3}+\dfrac{4}{x^2-x-6}=7$ is $x\neq$_____.

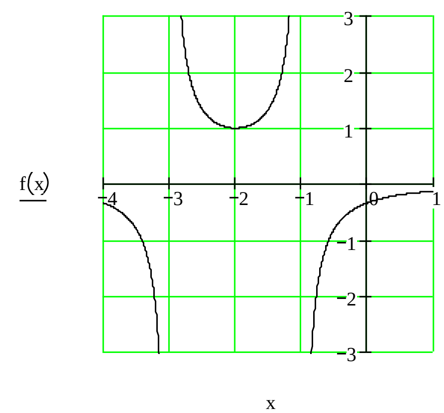


23 The graph of the reciprocal function $\dfrac{1}{f(x)}$ is shown to the right.

The *largest* x-intercept of $f(x)$ must be _____.

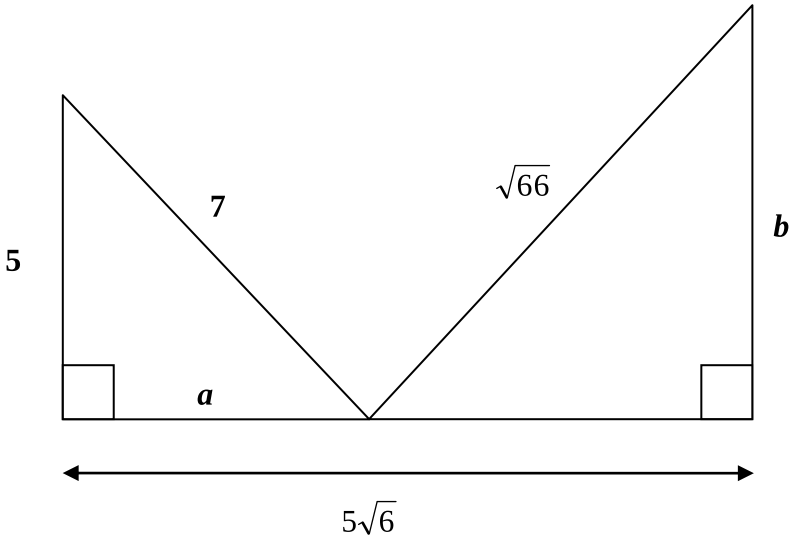
24 The rational function $f(x)=\dfrac{kx}{x^2-144}$, where $k\in R$ has asymptotes at $x=\pm a$. The value of a must be _____.

25 The rational function shown in the graph to the right has two vertical asymptotes. The function could be represented by the equation $f(x)=\dfrac{-1}{(x+1)(x+k)}$. The value of k must be _____ .



Written Response

1 Determine the exact values of a and b in simplified mixed radical form.



2 Express each of the below in simplest form. All denominators should be rationalized and all exponents shown as positive.

a. $(7\sqrt{3}-\sqrt{5})(2\sqrt{3}+3\sqrt{5})$	b. $\dfrac{5\sqrt{36}}{\sqrt{3}}$
c. $(2\sqrt{3}-\sqrt{2})^{2}$	d. $\sqrt{2}(5+\sqrt{6})-\sqrt{6}(\sqrt{8}-\sqrt{2})$

e. $3\sqrt{20}+7\sqrt{45}-\sqrt{80}$	f. $\dfrac{5\sqrt{11}+\sqrt{7}}{\sqrt{7}}$
g. $\dfrac{9\sqrt{3}}{2\sqrt{2}-\sqrt{5}}$	h. $11\sqrt[3]{16}+2\sqrt[3]{54}-8\sqrt[3]{128}$

3 A student is given three problems to solve. She *correctly* answers each question. Her answers are shown in the table below.

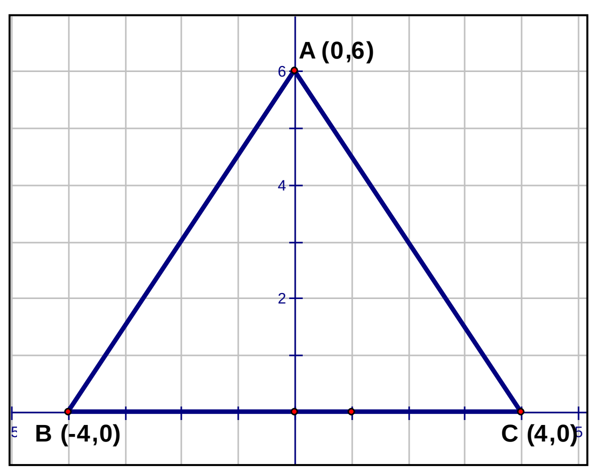
Problem	Problem #1	Problem #2	Problem #3
	Simplify $\sqrt{75}+\sqrt{48}+\sqrt{27}$	Expand and simplify $2\sqrt{2}-\sqrt{5}\ ^{2}$	Simplify $\dfrac{4}{\sqrt{2}}$ by rationalizing the denominator.
Solution	$12\sqrt{3}$	$13-4\sqrt{10}$	$2\sqrt{2}$

Determine how this student found her answers by showing all steps in each problem solution.

4 The following question is based on the diagram shown on the right.

a. Find the length of side AC using Pythagorean theorem ($a^2+b^2=c^2$), and represent your answer in **simplest mixed radical** form.

b. Using your answer from (a), express the **perimeter** of the triangle in **simplest mixed radical** form.



5 Complete each of the following;

a. Multiply $\sqrt{3}-\sqrt{2}$ by its conjugate, and simplify your solution.

b. An estimated value of $2\sqrt{26}$ is 10. Explain how a student can conclude that 10 is a correct estimation of $2\sqrt{26}$.

c. Write the expression $\dfrac{\sqrt{48}}{\sqrt{2}}$ in **simplest mixed radical** form.

d. **Rationalize the denominator** for the expression $\dfrac{\sqrt{32}}{\sqrt{3}}$.

e. Write $2\sqrt{10}$ as an **entire radical**.

6 Complete each of the following;

a. Multiply $2-\sqrt{5}$ by its conjugate, and simplify your solution.

b. Write the expression $\dfrac{\sqrt{72}}{\sqrt{6}}$ in simplest mixed radical form.

c. Divide $\dfrac{\sqrt{50}}{\sqrt{200}}$, and express your simplified answer with a rationalized denominator.

d. Multiply $3\sqrt{3}\ \ 5\sqrt{15}-2$ and express your answer in its simplest form.

7 Simplify each of the following and state all restrictions.

a. $\dfrac{5x^3}{2y}\times\dfrac{8y}{15x^2}$

b. $\dfrac{2a^2-7a-15}{2a-10}$

c. $\dfrac{t^2+4t+4}{t-2}\div\dfrac{3t+6}{t^2-5t+6}$

d. $\dfrac{a}{a^2-25}-\dfrac{2}{a^2-9a+20}$

8 Solve each of the following rational equations and state all restrictions.

a. $4+\frac{1}{2x}=5$

b. $\frac{4}{2x-1}=\frac{1}{x-2}$

9 A student is trying to solve the following problem. "*Dividing 20 by a number gives the same result as dividing 12 by 2 less than the same number*".

a. Set up an equation using the variable *x* that will solve the problem stated.

b. Solve your problem from (a) for *x* and state the restrictions.

10 Simplify each of the following and state all restrictions.

a. $\frac{4b}{3c^2}\div\frac{6b}{15ac}$

b. $\frac{6x^2-3x}{2x^2+5x-3}$

c. $\frac{x-6}{x^2-9x+18}\times\frac{x^2-6x+9}{2x-6}$

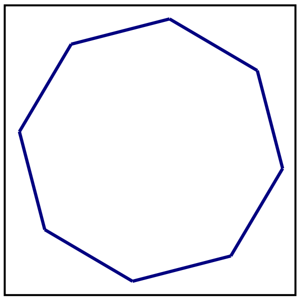
d. $\frac{x-7}{x^2-2x-15}+\frac{3x}{x-5}$

11 Solve each of the following rational equations and state any restrictions.

a. $\frac{3a-4}{2}+\frac{a+2}{5}=1$

b. $5-\frac{x-1}{x+3}=\frac{x+2}{x+3}$

12 In a regular polygon with n sides, the measure of each angle, a, is given by the formula $a=180-\frac{360}{n}$. Susan reasons that a rectangle is a regular polygon with 4 sides, and so $a=180-\frac{360}{4}$ giving each angle a measure of 90^o.



a. The diagram to the right is a regular polygon. What is the measure of each interior angle?

b. If each interior angle of a regular polygon is 156°, how many sides does it have?

13 Solve each of the following equations/inequalities *algebraically*. No marks will be given for solutions generated by graphical methods only. For complete marks, all restrictions must be stated.

a. $\dfrac{8}{x^2-16}+1=\dfrac{1}{x-4}$

b. $\sqrt{x+3}=x-3$

c. $|x+2|+|x-3|=16$

d. $\dfrac{2x^2}{x-3}-1=\dfrac{4x+6}{x-3}$

e. $\sqrt{x+2}+\sqrt{3-x}=3$

f. $|3x+2|=5$

14 A student attempts to solve the equation $\sqrt{x-5}-\sqrt{2x+7}=-3$. Their solution is shown below;

$$\begin{aligned}\sqrt{x-5}&=-3+\sqrt{2x+7}\\ x-5&=9+6\sqrt{2x+7}+2x+7\\ -x-21&=6\sqrt{2x+7}\\ x^2+441&=36(2x+7)\end{aligned}$$

a. At this point in their solution, the student has made *exactly two errors*. Recopy their steps shown above, and circle *exactly* where their errors have occurred. What are the *restrictions* to the solution of this problem?

b. The student correctly does the problem in their second attempt, and determines a simplified relation $x^2-30x+189=0$. *Solve this problem by factoring*.

c. Show that your answers from *c* correctly solve the problem $\sqrt{x-5}-\sqrt{2x+7}=-3$.

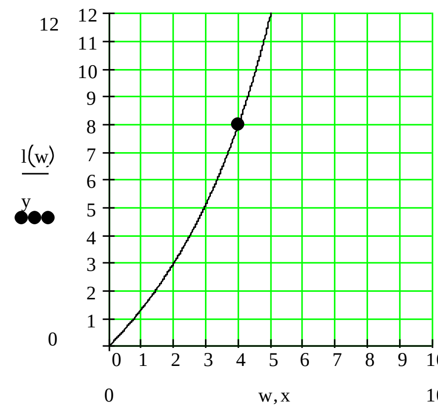
15. Each of the following equations has been *correctly* solved. Show, by algebraic methods, that the answers given must be the *only solutions* to each equation.

Category	**Rational**	**Radical**	**Absolute Value**
Equation	$\dfrac{x}{x-2}+\dfrac{1}{x+2}=\dfrac{8}{x^2-4}$	$2\sqrt{x-1}=x$	$\lvert 2x+1\rvert=x-3$
Solution	$x\neq\pm2,\quad x=-5$	$x>1,\quad x=2$	No real solution

16. A student is taking a quilting class. Her project will be a quilt, made of 120 squares sewn together. The original design calls for the quilt to be 10 squares wide.

a. What is the length of the quilt according to the original design?

b. The student decides to increase the length by l squares, at the same time reducing the width by w squares. She derives the formula $l = \dfrac{120}{w-10} + 12$, but later discovers some errors in her relation. State the proper relation between l and w.

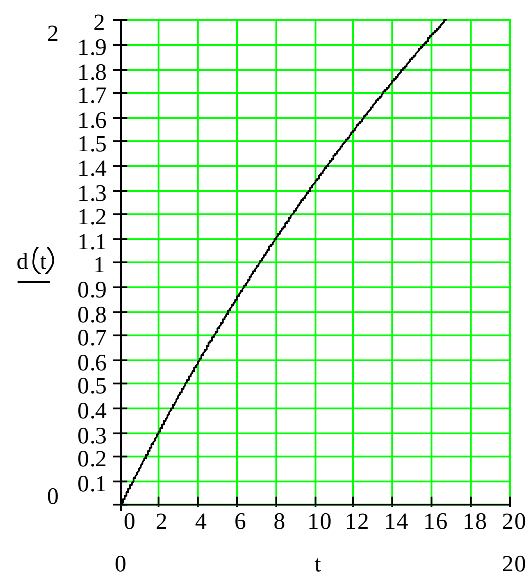


c. The *correct* graph of the relation from question (b) is shown on the right, with an ordered pair labelled on the graph. *Show* that the ordered pair results in a different quilt than the original design, but all 120 squares will still be used, and *explain your answer*.

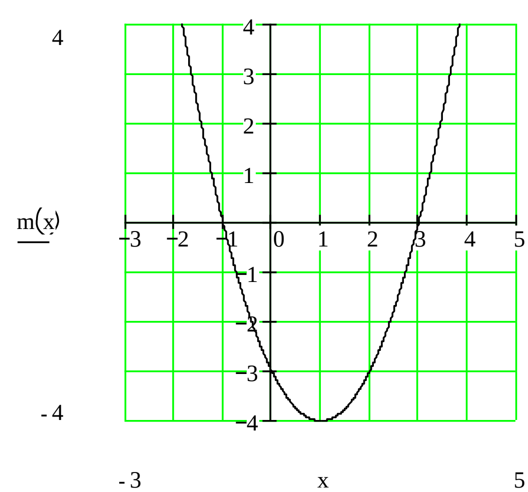
17. Rita trained for a marathon. After running the marathon, she looked back at her training program, and realized that she had run a total of 400 km spread over the 50 training days she used. Rita ran the same distance each day.

a. How far did Rita run each day?

b. Rita decides to write an article about her training methods. As part of her article, she would like to include a formula readers can use if they choose to use *more* than 50 days to run 400 km. She lets the variable t represent *the increase in number of training days*, and the variable d represent the corresponding *decrease in km run each day*. She generates the *incorrect* equation $d = \dfrac{400}{50+t} - 8$. Correct Rita's equation, and write your final expression as change in distance d relative to change in running days, t.



c. After generating the correct equation (with your help), Rita *correctly* publishes the graph shown on the right. Explain how a runner can make effective use of this graph to assist them in their training program, and *use specific information from the graph* in your detailed explanation.



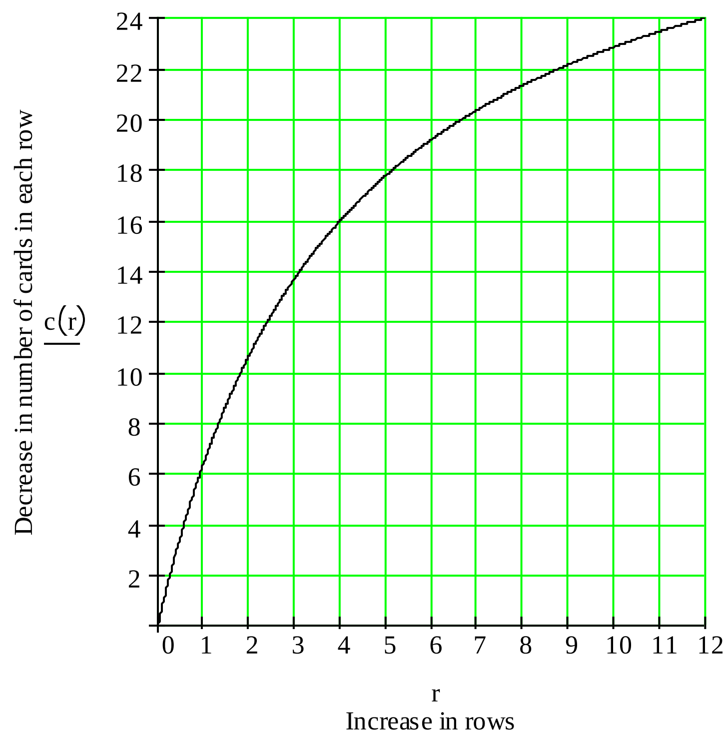
18. Sketch $\dfrac{1}{m(x)}$ using the graph to your right as a guide.

19. A student buys a memory card game for her younger brother. There are 128 cards in the game. When the game is played, the cards are arranged face down on a table, in rows, with an equal number of cards in each row. The goal of the game is to turn over matching cards, two at a time, in an attempt to match cards. There are 64 pairs of matching cards.

a. The first time the game is played, the cards are arranged in 4 rows as the rules of the game suggest. How many cards are in each row?

b. The Pure Math 20 student correctly identifies that she can represent different configurations of the game by increasing the number of rows, *r*, and decreasing the number of cards in each row, *c*, based on the suggestion in the rules as explained in (a). She determines an equation for the decrease in the number of cards in each row, *c*, relative to the increase in the number of rows, *r*, as $c = \frac{128}{4+r} + 32$, but has made an error in her expression. Determine the correct expression she is trying to model.

c. After generating the correct equation (with your help), the Pure Math 20 student *correctly* determines the graph on the right, which shows *c* as a function of *r*. According to this graph, if she increases the number of rows by 1, so she now has 5 rows, and she must decrease the number of cards in each row by 6. Explain why this *will not work* as a configuration for this game.



d. While the graph to the right is correct, it will only assist in certain configurations of the game. By choosing an ordered pair from this graph, explain how it will yield a possible configuration of the 128 cards used to play this game.