Rational and Irrational Numbers - Worksheet

Skill

Group A - Rational and irrational numbers

Determine whether each number is rational or irrational.

1) $\frac{5}{8}$

2) $\frac{1}{4}$

3) π

4) 6

5) 0

6) $\frac{-4}{7}$

7) $\sqrt{5}$

8) 3.8

9) $\sqrt{9}$

10) $\sqrt{\frac{1}{16}}$

11) $-\sqrt{8}$

12) $0.0\dot{9}$

Group B - Calculations with rational and irrational numbers

Complete the calculation to determine whether the solution is rational or irrational. Write your answers in the simplest form.

1) $6 \div 8$

2) 12×7

3) $\sqrt{4 \times 4}$

4) $\sqrt{25} \div 3$

5) $\sqrt{\frac{48}{6}}$

6) $\frac{5}{8} - \frac{10}{16}$

7) $\frac{3\pi}{\sqrt{16}}$

8) $\sqrt{50} \times \sqrt{2}$

9) $4\sqrt{12} \times \sqrt{6}$

10) $3 + \frac{7}{\sqrt{2}} \times \sqrt{2}$

11) $e^{2} \times e^{-2}$

12) $(\frac{\sqrt{6}}{3})^{4}$

Rational and Irrational Numbers - Worksheet

Group C - Finding rational and irrational numbers

Calculate a rational or irrational number between the two limits

1) Circle the rational number between 6 and 8

$\sqrt{48}$	7	$\frac{6}{8}$

2) Circle the rational number between 12 and 13

12.5	$\sqrt{12.5}$	4π

3) Circle the rational number between -10 and -9

$\sqrt{-90}$	-3π	-9.5

4) Circle the rational number between 8.1 and 8.7

8.5^2	8.2	$3e$

5) Circle the irrational number between 3 and 4

$\frac{3}{4}$	$\sqrt{10}$	3.5

6) Circle the irrational number between 10 and 12

$\sqrt{101}$	4π	$\frac{55}{5}$

7) Circle the irrational number between -5 and -8

$-\sqrt{26}$	$-\sqrt{16}$	-6.2

8) Circle the rational number between $\frac{3}{4}$ and $\frac{7}{8}$

0.9	$\frac{13}{16}$	$\sqrt{\frac{3}{4}}$

9) Circle the rational number between $\frac{7}{11}$ and $\frac{10}{13}$

$\sqrt{\frac{9}{16}}$	$\frac{8}{13}$	$\frac{\pi}{5}$

10) Circle the irrational number between 0.5 and 0.8

$\frac{7}{10}$	$\sqrt{0.26}$	0.799

11) Circle the irrational number between $\frac{3}{10}$ and $\frac{5}{6}$

$\frac{3}{\pi}$	$\frac{\sqrt{82}}{30}$	e^{-2}

12) Circle the irrational number between $\frac{4}{3}$ and $\frac{7}{5}$

$\frac{\sqrt{401}}{15}$	$\frac{3}{e}$	$\frac{\pi}{2}$

Rational and Irrational Numbers - Worksheet

Applied

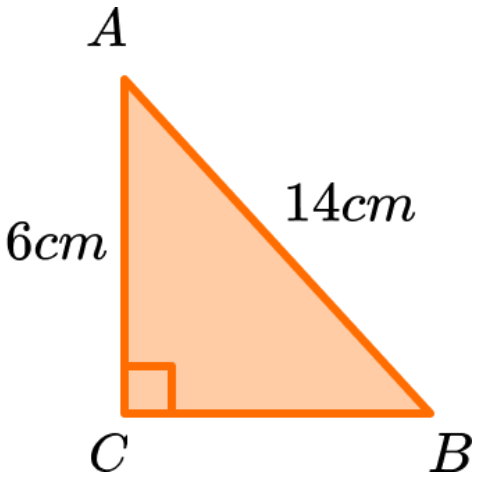
1) Below is a list of numbers.

$\sqrt{3}$ $\quad 6 \quad$ $\frac{8}{9}$ $\quad \pi \quad$ $\frac{\sqrt{3}}{2}$ $\quad -0.4 \quad$ e

(a) The rational numbers are: _____

(b) The irrational numbers are: _____

2) **(a)** Calculate the length BC of the right angle triangle below.



(b) State whether the solution to part a) is rational or irrational.

3) **(a)** Simplify $f(x) = 3x^2 \times 4x^{-3} \div 2x^{-5}$

(b) Show that $f(\sqrt{2})$ is a rational number.

4) **(a)** The volume of Sphere A is $V = \frac{4}{3}\pi r^3$. Is V always, sometimes or never an irrational number? Give reasons for your answer.

(b) Given that the volume of Sphere B is equal to 36π, show that the radius r is a rational number.

Rational and Irrational Numbers - Exam Questions

1) **(a)** Show that $\sqrt{3}(4 + \sqrt{3})$ is an irrational number.

.....

(2)

(b) Show that $(\frac{1}{2} + \sqrt{3})(\frac{1}{2} - \sqrt{3})$ is a rational number.

.....

(3)

(5 marks)

---

2) **(a)** The ratio of sides of a right angle triangle is equal to 5: 12: x.
Calculate the two possible solutions for x.

.....

(2)

(b) The diagonal length L of a cuboid can be calculated by the formula $L = \sqrt{h^2 + w^2 + d^2}$ where h, w, and d are the values for the height, width and depth of the cuboid. Given that $h = \sqrt{2}$, $w = \sqrt{3}$, and $d = 2$, calculate L.

.....

(3)

(5 marks)

Rational and Irrational Numbers - Exam Questions

3) **(a)** Simplify $\frac{\sqrt{128}}{8}$.

.....

(2)

(b) Let $y > \frac{x^2}{\sqrt{5}}$. If $y = 20\sqrt{80}$, calculate the range of values for x.

.....

(4)

(6 marks)

---

4) **(a)** The golden ratio is equal to $\frac{1+\sqrt{5}}{2}$. Is the golden ratio a rational or irrational number?

.....

(1)

(b) Calculate the positive solution of x for the quadratic equation $x^2 - x - 1 = 0$. What do you notice?

.....

(4)

(5 marks)

Rational and Irrational Numbers - Answers

	Question	Answer
	Skill Questions	
Group A	Determine whether each number is rational or irrational.	
	1) $\frac{5}{8}$	**1)** Rational
	2) $\frac{1}{4}$	**2)** Rational
	3) π	**3)** Irrational
	4) 6	**4)** Rational
	5) 0	**5)** Rational
	6) $\frac{-4}{7}$	**6)** Rational
	7) $\sqrt{5}$	**7)** Irrational
	8) 3.8	**8)** Rational
	9) $\sqrt{9}$	**9)** Rational
	10) $\sqrt{\frac{1}{16}}$	**10)** Rational
	11) $-\sqrt{8}$	**11)** Irrational
	12) $0.0\dot{9}$	**12)** Rational
Group B	Complete the calculation to determine whether the solution is rational or irrational. Write your answers in the simplest form.	
	1) $6 \div 8$	**1)** $\frac{3}{4}$ rational
	2) 12×7	**2)** 84 rational
	3) $\sqrt{4 \times 4}$	**3)** 4 rational
	4) $\sqrt{25} \div 3$	**4)** $\frac{5}{3}$ rational

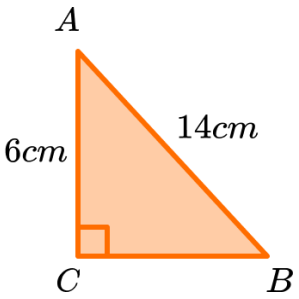
Rational and Irrational Numbers - Answers

Group B contd	**5)** $\sqrt{\frac{48}{6}}$	**5)** $2\sqrt{2}$ irrational
	6) $\frac{5}{8} - \frac{10}{16}$	**6)** 0 rational
	7) $\frac{3\pi}{\sqrt{16}}$	**7)** $\frac{3\pi}{4}$ Irrational
	8) $\sqrt{50} \times \sqrt{2}$	**8)** 10 rational
	9) $4\sqrt{12} \times \sqrt{6}$	**9)** $24\sqrt{2}$ irrational
	10) $3 + \frac{7}{\sqrt{2}} \times \sqrt{2}$	**10)** $3\sqrt{2} + 7$ irrational
	11) $e^2 \times e^{-2}$	**11)** $e^0 = 1$ rational
	12) $(\frac{\sqrt{6}}{3})^4$	**12)** $\frac{4}{9}$ rational
Group C	Calculate a rational or irrational number between the two limits	
	1) Circle the rational number between 6 and 8 $\sqrt{48}$ | 7 | $\frac{6}{8}$	**1)** 7
	2) Circle the rational number between 12 and 13 12.5 | $\sqrt{12.5}$ | 4π	**2)** 12.5
	3) Circle the rational number between -10 and -9 $\sqrt{-90}$ | -3π | -9.5	**3)** -9.5
	4) Circle the rational number between 8.1 and 8.7 8.5^2 | 8.2 | $3e$	**4)** 8.2
	5) Circle the irrational number between 3 and 4 $\frac{3}{4}$ | $\sqrt{10}$ | 3.5	**5)** $\sqrt{10}$

Rational and Irrational Numbers - Answers

Group C contd	**6)** Circle the irrational number between 10 and 12 $\sqrt{101}$ | 4π | $\frac{55}{5}$	**6)** $\sqrt{101}$
	7) Circle the irrational number between -5 and -8 $-\sqrt{26}$ | $-\sqrt{16}$ | -6.2	**7)** $-\sqrt{26}$
	8) Circle the rational number between $\frac{3}{4}$ and $\frac{7}{8}$ 0.9 | $\frac{13}{16}$ | $\sqrt{\frac{3}{4}}$	**8)** $\frac{13}{16}$
	9) Circle the rational number between $\frac{7}{11}$ and $\frac{10}{13}$ $\sqrt{\frac{9}{16}}$ | $\frac{8}{13}$ | $\frac{\pi}{5}$	**9)** $\sqrt{\frac{9}{16}}$
	10) Circle the irrational number between 0.5 and 0.8 $\frac{7}{10}$ | $\sqrt{0.26}$ | 0.799	**10)** $\sqrt{0.26}$
	11) Circle the irrational number between $\frac{3}{10}$ and $\frac{5}{6}$ $\frac{3}{\pi}$ | $\frac{\sqrt{82}}{30}$ | e^{-2}	**11)** $\frac{\sqrt{82}}{30}$
	12) Circle the irrational number between $\frac{4}{3}$ and $\frac{7}{5}$ $\frac{\sqrt{401}}{15}$ | $\frac{3}{e}$ | $\frac{\pi}{2}$	**12)** $\frac{\sqrt{401}}{15}$

Rational and Irrational Numbers - Answers

	Question	Answer
	Applied Questions	
1)	Below is a list of numbers. $\sqrt{3}$ $\quad 6 \quad \frac{8}{9} \quad \pi \quad \frac{\sqrt{3}}{2} \quad -0.4 \quad e$	
	a) The rational numbers are: _____	**a)** $6, \frac{8}{9}, -0.4$
	b) The irrational numbers are: _____	**b)** $\sqrt{3}, \pi, \frac{\sqrt{3}}{2}, e$
2)	**a)** Calculate the length BC of the right angle triangle below.  	**a)** $14^2 - 6^2 = 196 - 36$ $= 160$ $\sqrt{160} = 4\sqrt{10}$
	b) State whether the solution to part a) is rational or irrational.	**b)** Irrational
3)	**a)** Simplify $f(x) = 3x^2 \times 4x^{-3} \div 2x^{-5}$	**a)** $f(x) = 6x^4$
	b) Show that $f(\sqrt{2})$ is a rational number.	**b)** $f(\sqrt{2}) = 6 \times (\sqrt{2})^4 = 6 \times 4 = 24$
4)	**a)** The volume of Sphere A is $V = \frac{4}{3}\pi r^3$. Is V always, sometimes or never an irrational number? Give reasons for your answer.	**a)** Always. The only time V is not rational is when $r = 0$ which means that the sphere does not exist. Multiplying π by any other positive number is an irrational number.
	b) Given that the volume of Sphere B is equal to 36π, show that the radius r is a rational number.	**b)** $36\pi = \frac{4}{3}\pi r^3$ $108 = 4r^3$ $27 = r^3$ $r = 3$

Rational and Irrational Numbers - Mark Scheme

	Question	Answer	
	Exam Questions		
1) (a)	Show that $\sqrt{3}(4 + \sqrt{3})$ is an irrational number.	(a) $4\sqrt{3} + \sqrt{9}$ $= 4\sqrt{3} + 3$	(1) (1)
(b)	Show that $(\frac{1}{2} + \sqrt{3})(\frac{1}{2} - \sqrt{3})$ is a rational number.	(b) $\frac{1}{4} - \frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2} - 3$ $\frac{1}{4} - 3$ $-2\frac{3}{4}$	(1) (1) (1)
2) (a)	The ratio of sides of a right angle triangle is equal to $5 : 12 : x$. Calculate the two possible solutions for x.	(a) $\sqrt{12^2 + 5^2} = 13$ $\sqrt{12^2 - 5^2} = \sqrt{119}$	(1) (1)
(b)	The diagonal length L of a cuboid can be calculated by the formula $L = \sqrt{h^2 + w^2 + d^2}$ where h, w, and d are the values for the height, width and depth of the cuboid. Given that $h = \sqrt{2}$, $w = \sqrt{3}$, and $d = 2$, calculate L.	(b) $L = \sqrt{(\sqrt{2})^2 + (\sqrt{3})^2 + 2^2}$ $L = \sqrt{2 + 3 + 4}$ $L = \sqrt{9} = 3$	(1) (1) (1)
3) (a)	Simplify $\frac{\sqrt{128}}{8}$.	(a) $\frac{8\sqrt{2}}{8}$ $\sqrt{2}$	(1) (1)
(b)	Let $y > \frac{x^2}{\sqrt{5}}$. If $y = 20\sqrt{80}$, calculate the range of values for x.	(b) $20\sqrt{80} > \frac{x^2}{\sqrt{5}}$ $400 > x^2$ $0 > x^2 - 400$ $0 > (x - 20)(x + 20)$ $-20 < x < 20$	(1) (1) (1) (1)

Rational and Irrational Numbers - Mark Scheme

4) (a)	The golden ratio is equal to $\frac{1+\sqrt{5}}{2}$. Is the golden ratio a rational or irrational number?	**(a)** Irrational	**(1)**
(b)	Calculate the positive solution of x for the quadratic equation $x^2 - x - 1 = 0$. What do you notice?	**(b)** $x = \frac{1+\sqrt{(-1)^2-4\times1\times-1}}{2\times1}$ $x = \frac{1+\sqrt{1+4}}{2}$ $x = \frac{1+\sqrt{5}}{2}$ The positive solution is the golden ratio.	**(1)** **(1)** **(1)** **(1)**