



## Algebra

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**2009**

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- 12 The symbol  $\diamond$  defines a mathematical binary operation such that  $y \diamond x = \frac{y^x}{x}$  for all positive integers.

What is the value of  $(2 \diamond 3) \diamond 2$ ?

- A  $2 \times 3^3$
- B  $8/3$
- C  $32/9$
- D 4
- E  $2^5 \sqrt{2}/9$



## Algebra

**24** The equation gives  $y$  in terms of  $x$ .

$$y = 5\left(\frac{x}{2} - 3\right)^2 - 10$$

Rearrange the equation to give an expression for  $x$  in terms of  $y$ .

**A**  $\pm 2\sqrt{\frac{y+10}{5}} + 6$

**B**  $\pm 2\sqrt{\frac{y+10}{5}} - 6$

**C**  $\pm 2\sqrt{\frac{y-10}{5}} + 6$

**D**  $\pm 2\sqrt{\frac{y-10}{5}} - 6$

**E**  $\pm 2\sqrt{\frac{y+50}{5}} + 6$

**F**  $\pm 2\sqrt{\frac{y+10}{5}} + 3$



## Algebra

# 2010

- 4 I have two containers with different capacities. Initially, the larger one is full of water and the smaller one is empty. I pour water from the larger container into the smaller container until they contain the same volume of water. The volume of water in the large container is now  $p$  times its capacity and the volume of water in the small container is  $q$  times its capacity.

Which one of the following statements about  $p$  and  $q$  must be true?

- A  $p + q = 1$  (but  $p$  and  $q$  are not necessarily both 0.5)
- B  $p = 0.5$  and  $q = 0.5$
- C  $p = 0.5$  and  $q > 0.5$
- D  $p > 0.5$  and  $q = 0.5$
- E  $p > 0.5$  and  $q > 0.5$
- 12 The mean time for running a race by a group of 20 people was 54 seconds. The times for a second group of people were added and the value of the mean went up to 56 seconds.
- Which formula represents the relationship between the number of people in the second group,  $P$ , and the mean time of the second group,  $T$ ?

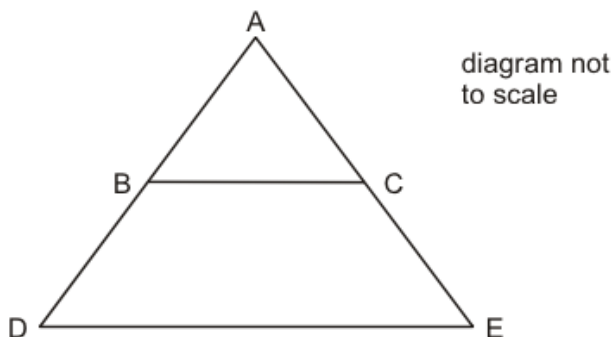
- A  $P = \frac{40}{T - 54}$
- B  $P = \frac{1080}{T - 54}$
- C  $P = \frac{40}{T - 56}$
- D  $P = \frac{1080}{T - 56}$
- E  $P = \frac{1120}{T} - 20$



## Algebra

- 16** A shape is formed by drawing a triangle ABC inside the triangle ADE.  
 BC is parallel to DE.

$$AB = 4\text{cm} \quad BC = x\text{cm} \quad DE = x + 3\text{cm} \quad DB = x - 4\text{cm}$$



Calculate the length of DE.

- A**      5cm
  - B**      7cm
  - C**      9cm
  - D**       $4 + 2\sqrt{7}$  cm
  - E**       $7 + 2\sqrt{7}$  cm
- 20** The total surface area of a cylinder is numerically the same as its volume.  
 The radius of the cylinder is  $r$  cm, the height is  $h$  cm.

Express  $h$  in terms of  $r$ .

- A**       $h = \frac{2r}{r-2}$
- B**       $h = \frac{2r}{r+2}$
- C**       $h = r+2$
- D**       $h = r-2$
- E**       $h = 2r(r-2)$



## Algebra

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# 2011

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4 Simplify:

$$3x(3x^{-\frac{1}{3}})^3$$

- A  $\frac{1}{9}$
- B 1
- C 81
- D  $\frac{x^2}{9}$
- E  $x^2$
- F  $81x^2$

12  $w, x, y$  and  $z$  are integers such that  $w < x^2$ ,  $x > y^2$ ,  $y^2 < z^2$  and  $x > z$ .

Which one of the following inequalities **must** be true?

- A  $w < x$
- B  $w > y$
- C  $w < z$
- D  $x > y$
- E  $y < z$

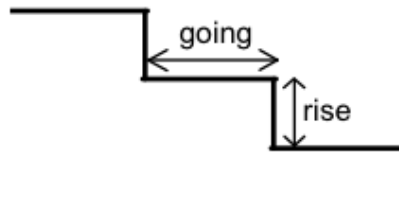


## Algebra

# 2012

- 8 A formula which connects the 'going',  $G$ , with the 'rise',  $R$ , of stairs in a staircase is below:

$$G = 5 + \sqrt{7(9 - R)^2 + 9}$$



Rearrange the formula to give  $R$  in terms of  $G$ .

**A**  $R = 9 - \sqrt{\frac{(G - 5)^2 + 9}{7}}$

**B**  $R = 9 - \frac{G - 8}{\sqrt{7}}$

**C**  $R = 9 + \sqrt{\frac{(G - 5)^2 - 9}{7}}$

**D**  $R = 9 + \frac{G - 8}{\sqrt{7}}$

**E**  $R = 9 - \sqrt{\frac{(G - 5)^2 - 9}{7}}$



## Algebra

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**2013**

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- 4 Given that  $x = 4.6 \times 10^7$  and  $y = 2 \times 10^6$ , what is the value of  $\frac{x+7y}{x-2y}$  ?
- A**  $\frac{10}{7}$
- B**  $1\frac{2}{3}$
- C** 3.1
- D** 7
- E** 10
- F** 31



## Algebra

16 Three variables  $x$ ,  $y$  and  $z$  are known to be related to each other in the following ways:

- $x$  is directly proportional to the square of  $z$
- $y$  is inversely proportional to the cube of  $z$ .

Which of the following correctly describes the relationship between  $x$  and  $y$ ?

- A The square of  $x$  is directly proportional to the cube of  $y$ .
- B The square of  $x$  is inversely proportional to the cube of  $y$ .
- C The cube of  $x$  is directly proportional to the square of  $y$ .
- D The cube of  $x$  is inversely proportional to the square of  $y$ .
- E  $x$  is directly proportional to  $y^6$ .





## Algebra

8 Simplify:

$$4 - \frac{x^2(1-16x^2)}{(4x-1)2x^3}$$

A  $2 - \frac{1}{2x}$

B  $2 + \frac{1}{2x}$

C  $4 - \frac{1}{2x}$

D  $4 + \frac{1}{2x}$

E  $6 - \frac{1}{2x}$

F  $6 + \frac{1}{2x}$



## Algebra

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# 2014

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4 Simplify:

$$\frac{x^2 - 4x}{x^2 - 16}$$

- A  $\frac{x}{4}$
- B  $\frac{x}{x+4}$
- C  $\frac{x}{x-4}$
- D  $\frac{1}{4}$
- E  $\frac{x-4}{x-16}$

8 Given that  $4^p \times 8^q = 2^n$ , express  $n$  in terms of  $p$  and  $q$ .

- A  $n = p + q$
- B  $n = 2p + 3q$
- C  $n = 2p + 4q$
- D  $n = p + q + 5$
- E  $n = 6pq$



## Algebra

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# 2015

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- 12 Given that  $a = \frac{3}{5+X}$ ,  $b = \frac{3+X}{5}$  and  $c = \frac{3+X}{5+X}$ , where  $X$  is a whole number greater than zero, which one of the following is true?
- A  $a < b < c$  for all values of  $X$
  - B  $a < c < b$  for all values of  $X$
  - C  $b < a < c$  for all values of  $X$
  - D  $b < c < a$  for all values of  $X$
  - E  $c < a < b$  for all values of  $X$
  - F  $c < b < a$  for all values of  $X$
  - G The order of the fractions depends on the value of  $X$



## Algebra

- 20 A class of  $n$  pupils takes a spelling test. Their mean score for the test is  $m$ . Another pupil takes the test and scores  $n$ . When this pupil's result is included with the other results it is found that the mean has decreased by 2.

Which equation below gives the correct expression for  $n$  in terms of  $m$ ?

A  $n = \frac{m}{m-1}$

B  $n = \frac{m}{m-3}$

C  $n = \frac{2}{m-3}$

D  $n = \frac{m-2}{3}$

E  $n = \frac{m+2}{m-1}$

F  $n = \frac{m}{3}$

G  $n = \frac{m+2}{3}$



## Algebra

24 Simplify:

$$\frac{2x+3}{2x-3} + \frac{2x-3}{2x+3} - 2$$

A      0

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

C       $\frac{18}{(2x-3)(2x+3)}$

D       $\frac{36}{(2x-3)(2x+3)}$

E       $\frac{8(x^2-2)}{(2x-3)(2x+3)}$

F       $\frac{12}{2x-3}$



## Algebra

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# 2016

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20 Rearrange the formula  $\frac{a}{b} = \frac{c}{d} + \frac{e}{f}$  to make  $f$  the subject.

A  $f = \frac{bce - ade}{ac}$

B  $f = \frac{bc + be - ad}{a}$

C  $f = \frac{bde}{ad - bc}$

D  $f = \frac{bcd}{ad - be}$

E  $f = \frac{bc + be}{ad}$