# Merit

1. Simplify: $\frac{3a^2-15ab}{6a^2}$

(2004)

2. John saved \$4000 for a trip to the Olympic Games.
He wanted to buy as many tickets to the swimming as possible.
Each ticket to the swimming costs \$85.
Travel, food and accommodation cost \$3100.
Use this information to write an equation **or** inequation.

Solve your equation or inequation.

What is the greatest number of tickets to the swimming that John could buy?

(2004)

3 Janet bought tickets to the diving and the swimming at the Olympic Games.
She paid \$1095 for 15 tickets.
The tickets for the diving cost \$65 and the tickets for the swimming cost \$85.
Solve the pair of simultaneous equations to find the number of tickets Janet bought for the swimming.

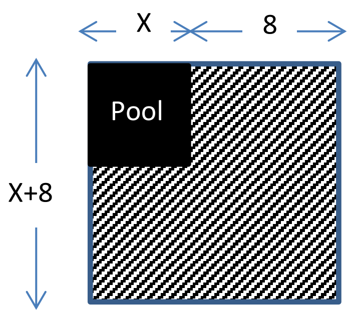
$65d + 85w = 1095$
$d + w = 15$

(2004)

4. Simplify: $\frac{x}{3} + \frac{x}{5}$

(2005)

5. The diagram shows a **square** courtyard with a **square** pool in one corner.




The area of the courtyard is 225 m2, and the courtyard extends 8 m beyond the pool.
Solve the equation 225 = $(x + 8)^2$, to find $x$, the **length of the side of the pool**.

(2005)

6. Mr Smith spends \$1210 on 1390 square tiles to use on the bathroom floor.
He buys $S$ small tiles for 80 cents each and $B$ big tiles for \$1.50 each.
Solve the pair of simultaneous equations to find the **number of tiles of each size** that Mr Smith bought.

$0.8S + 1.5B = 1210$
$S + B = 1390$

(2005)

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7. Simplify: $\frac{x^2+7x+10}{x+2}$

(2006)

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8. Peter has more than twice as many CDs as Mary.
Altogether they have 97 CDs.
Write a relevant equation, and use it to find the **least number** of CDs that Peter could have.

(2006)

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9. Paul bought some CDs in a sale.
He bought four times as many popular CDs as classical CDs.
The popular CDs, $P$, were \$1.50 each.
The classical CDs, $C$, were 50 cents each.
He spent \$52 altogether.
Solve these equations to find out how many classical CDs Paul bought.

$4C = P$
$1.5P + 0.5C = 52$

(2006)

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10. Simplify fully: $\frac{(2p^2-12pq)}{6p^2}$

(2007)

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11. Graham is using the formula $A = \pi\sqrt{\frac{w}{g}}$
He wants to make $w$ the subject of the formula.
Rewrite the formula with $w$ as the subject.

(2007)

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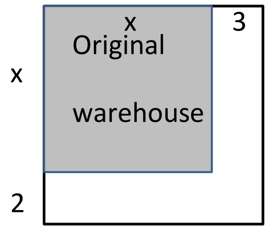
12. The sides of a square warehouse are extended by 2 m and 3 m as shown in the diagram.




The area of the extended warehouse is 156 m$^2$.
Solve the equation $(x + 2)(x + 3) = 156$ to find the length of one side of the original warehouse.

(2007)

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13. Simplify: $\frac{2m}{3} + \frac{4m}{5}$

(2008)

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14. There are $V$ litres of water in David's tank.
There are $d$ "drippers" on the irrigation line from the tank that can be used to water his garden.
Each "dripper" uses $x$ litres of water per day.

(a) Write an expression to show the amount of water, $A$, left in the tank after one day.

(b) At the end of the day on the 2nd of November there were 120 litres of water in the tank.
The next day, 3 "drippers" were used.
At the end of that day there were 39 litres of water left.

Use your expression above to show how much water each "dripper" used that day.

(2008)

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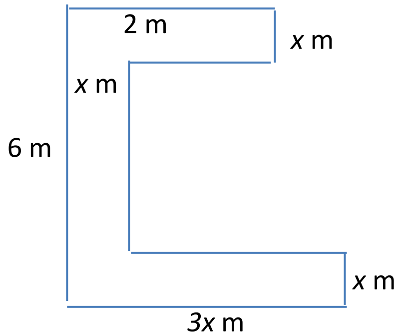
15. Jim needs to make a path from the front to the back of his house, as shown in the diagram.




$x$ is the width of his path, in metres.
Jim has sufficient concrete to make a path with a total area of 9 m$^2$.
The area of the path can be written as $2x + 3x^2 + (6 - 2x)x = 9$
Solve the equation $x^2 + 8x - 9 = 0$ to find the width of the path around his house.

(2008)

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16. Steven sets Jan a mathematics problem about a mystery number:
"Three minus twice the mystery number is greater than 7."
Form an inequality and use it to find all possible values of the mystery number.

(2009)

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17. The surface area of a ball is given by $A = 4\pi r^2$, where $r$ is the radius of the ball.
Give the formula for the radius of a ball.
(Make $r$ the subject.)

(2009)

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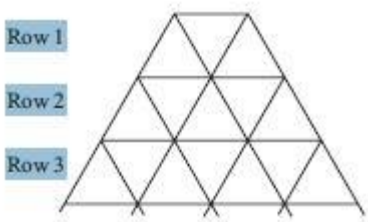
18. Peg makes a patchwork rug by sewing small equilateral triangles together to form a pattern.
Her pattern uses rows of equilateral triangles, as shown in the diagram.




There are $n$ rows of equilateral triangle patches to make up the pattern.
Write an expression to find $P$, the total number of equilateral triangles used to make the pattern in terms of $n$, the number of rows.

(2009)

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19. Emma has an 8 m long piece of rope that she uses to make the circumference of a circle.
$C = 2\pi r$, $A = \pi r^2$
Calculate the area of the circle.

(2010)

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20. $x^2 + ax - 8 = (x + b)(x + c)$
where $a$ is a whole number greater than 0, and $b$ and $c$ are both integers.
Give all possible values for $a$.

(2010)

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# Answers

1. $\frac{a-5b}{2a}$

2. $85T \leq 900$ or $85T = 900$ Number of tickets = 10

3. Number of swimming tickets is 6

4. $\frac{8x}{15}$

5. $x \pm 8 = 15$ or $x^2 + 16x - 161 = 0$ $(x+23)(x-7) = 0$
   So x = 7 or -23 therefore side has to be 7m

6. 1250 small tiles, 140 big tiles

7. $\frac{(x+5)(x+2)}{x+2} = x + 5$

8. $x + 2x = 97$, $3x = 97$ $so$ $x = 32.33$ Peter must have at least 65 CD's

9. 8 classical CD's

10. $\frac{2p(p-6q)}{6p^2}$ or $\frac{2(p^2-6pq)}{6p^2}$ or $\frac{p(2p-12q)}{6p^2}$ = $\frac{p-6q}{3p}$ $or$ $\frac{p^2-6pq}{3p^2}$ $or$ $\frac{2p-12q}{6p}$

11. $w = \frac{A^2 g}{\pi^2}$ $or$ $\left(\frac{A}{\pi}\right)^2 g$

12. 10 metres

13. $\frac{22m}{15}$

14. a) Volume A = V – dx b) each dripper uses 27 litres that day

15. $x^2 + 8x - 9 = 0$ , $(x+9)(x-1) = 0$, $x = -9$ $or$ $1$, Width of path = 1m

16. $3 - 2x > 7$ , $x < -2$

17. $r = \sqrt{\frac{A}{4\pi}}$

18. $P = n^2 + 2n$

19. $2\pi r = 8$ , $r = \frac{8}{2\pi}$ , $r = \frac{4}{\pi} = 1.2732 \ldots$ $A = \pi r^2 = 5.092958$

20. b = 4 and c = -2 so a = 2 AND b = 8 , c = -1 so a = 7