

# Topic Test: Algebraic Skills and Techniques

Remember: these are HSC-type questions.

Time allowed: 40 minutes Total marks: 25

## Part A (Suggested time: 15 minutes)

Choose the correct answer (A, B, C or D) for each question. One mark each

1  $8a^2 + 7a - 5a^2 + a = ?$

- A  $3a^2 + 6a$                       B  $13a^2 + 8a$   
C  $3a^2 + 8a$                       D  $13a^2 + 6a$

2 If  $x = 2$ ,  $y = 3$  and  $z = 10$ , then  $xyz^2 = ?$

- A 600                                  B 1800  
C 3600                                D 1200

3 Expand and simplify  $3x(2x - 4) + 5x(x + 1)$

- A  $11x^2 + 7x$                       B  $11x^2 - 7x$   
C  $11x^2 - 11x$                       D  $11x^2 + 13x$

4 The solution to the equation  $8x - 9 = 2x + 3$  is?

- A  $x = 0.6$                             B  $x = 1$   
C  $x = 1.2$                             D  $x = 2$

5 Which is a correct rearrangement of the formula

$A = \frac{h}{2}(a + b)?$

- A  $a = \frac{2A}{h} - b$                       B  $b = a - \frac{2A}{h}$   
C  $h = \frac{2A}{a} + b$                       D none of these

6 The product of  $3.2 \times 10^5$  and  $2.7 \times 10^6$  is?

- A  $3.02 \times 10^6$                       B  $8.64 \times 10^{11}$   
C  $-2.38 \times 10^6$                       D  $2.37 \times 10^{-7}$

7 Between what two values must  $x$  lie if  $2.4^x = 1500$ ?

- A 8.3 and 8.4                      B 1.6 and 1.7  
C 6.2 and 6.3                      D 21.0 and 21.1

8  $4m^4 \times 3m^3 = ?$

- A  $7m^7$                                 B  $7m^{12}$   
C  $12m^7$                                 D  $12m^{12}$

9 Given that  $c^2 = a^2 + b^2 - 2ab \cos C$  and that  $a = 13$ ,

$b = 18$  and  $\cos C = \frac{1}{9}$  find  $c$  ( $c > 0$ ).

- A  $1\frac{2}{3}$                                   B 21  
C 23                                    D 441

10 Which of the numbers  $\frac{17}{10\,000}$ ,  $0.0003$ ,

$6.897 \times 10^{-4}$  and  $2.5 \times 10^{-3}$  is the largest?

- A  $\frac{17}{10\,000}$                               B 0.0003  
C  $6.897 \times 10^{-4}$                       D  $2.5 \times 10^{-3}$

**Part B**

(Suggested time: 25 minutes)

Show all working.

15 marks

- 11** Simplify:
- a  $7p + 3q - 4p + 5q$  1 mark
- b  $\frac{9ab^2}{12a^2b}$  1 mark
- c  $3x^2yz^4 \times 2x^3y^2z$  1 mark
- d  $15n^9 \div 5n^3 + 2n \times 4n^5$  2 marks
- 12** If  $m = 7$ , evaluate  $2m^2 - 3m + 5$  1 mark
- 13** Solve  $\sqrt{3x-5} = 7$  2 marks
- 14** Consider the formula  $V = \frac{1}{3}\pi r^2 h$ :  
(You may assume  $r > 0$ .)
- a Change the subject of the formula to  $r$ . 2 marks
- b If  $V = 157$  and  $h = 6$ , find  $r$ . 1 mark
- 15** A light-year is a measure of distance.  
It is the distance that light travels in one year.  
If the speed of light is  $3 \times 10^8$  kilometres per second,  
find the length of a light-year in kilometres.  
Give the answer in scientific notation, correct  
to two significant figures. (You may assume  
that there are 365 days in a year.) 2 marks
- 16** Use the estimation and refinement technique  
to find the value of  $n$ , to the nearest whole  
number, for which  $3000 = 850(1.007)^n$ . 2 marks

Go to p 292 for Quick Answers  
or to p 356 for Worked Solutions

# Solutions

## Topic Test ..... p239

**1**  $8a^2 + 7a - 5a^2 + a = 3a^2 + 8a$  C

**2** If  $x = 2, y = 3$  and  $z = 10$ ,  
 $xyz^2 = 2 \times 3 \times 10^2$   
 $= 600$  A

**3**  $3x(2x - 4) + 5x(x + 1)$   
 $= 6x^2 - 12x + 5x^2 + 5x$   
 $= 11x^2 - 7x$  B

**4**  $8x - 9 = 2x + 3$   
 $8x = 2x + 12$   
 $6x = 12$   
 $x = 2$  D

**5**  $A = \frac{h}{2}(a + b)$   
 $2A = h(a + b)$   
 $h = \frac{2A}{a + b}$  [not C]  
 $2A = h(a + b)$   
 $\frac{2A}{h} = a + b$   
 $b = \frac{2A}{h} - a$  [not B]  
 $a = \frac{2A}{h} - b$  A

**6**  $3.2 \times 10^5 \times 2.7 \times 10^6 = 8.64 \times 10^{11}$  B

**7**  $2.4^x = 1500$   
 $2.4^{83} = 1431.3746 \dots$   
 $2.4^{84} = 1562.335\ 965 \dots$   
 $x$  lies between 8.3 and 8.4 A

**8**  $4m^4 \times 3m^3 = 12m^7$  C

**9**  $c^2 = a^2 + b^2 - 2ab \cos C$   
 $a = 13, b = 18$  and  $\cos C = \frac{1}{9}$   
 $c^2 = 13^2 + 18^2 - 2 \times 13 \times 18 \times \frac{1}{9}$   
 $= 441$   
 $c = \sqrt{441}$  ( $c > 0$ )  
 $= 21$  B

**10**  $\frac{17}{10\ 000} = 0.0017$   
 $0.0003 = 0.0003$   
 $6.897 \times 10^{-4} = 0.000\ 6897$   
 $2.5 \times 10^{-3} = 0.0025$   
 $0.0025$  is the largest D

**11** a  $7p + 3q - 4p + 5q = 3p + 8q$  ✓

b  $\frac{9ab^2}{12a^2b} = \frac{3b}{4a}$  ✓

c  $3x^2yz^4 \times 2x^3y^2z = 6x^5y^3z^5$  ✓

d  $15n^9 + 5n^3 + 2n \times 4n^5$   
 $= 3n^6 + 8n^6$   
 $= 11n^6$  ✓

**12** If  $m = 7$ ,  
 $2m^2 - 3m + 5 = 2 \times 7^2 - 3 \times 7 + 5$   
 $= 82$  ✓

**13**  $\sqrt{3x - 5} = 7$   
 $3x - 5 = 49$  [squaring both sides] ✓  
 $3x = 54$   
 $x = 18$  ✓

**14**  $V = \frac{1}{3}\pi r^2 h$   
 a  $V = \pi r^2 h$   
 $r^2 = \frac{3V}{\pi h}$  ✓  
 $r = \sqrt{\frac{3V}{\pi h}}$  ( $r > 0$ ) ✓

b If  $V = 157$  and  $h = 6$ ,  
 $r = \sqrt{\frac{3V}{\pi h}}$   
 $= \sqrt{\frac{3 \times 157}{\pi \times 6}}$   
 $= 4.998\ 732\ 446 \dots$   
 $\approx 5$  ✓

**15** Let  $d$  km be the distance.  
 $d = 3 \times 10^5 \times 60 \times 60 \times 24 \times 365$  ✓  
 $= 9.4608 \times 10^{12}$   
 $= 9.5 \times 10^{12}$  (2 sig. figs) ✓

**16**  $3000 = 850(1.007)^n$   
 $n = 181$  (nearest whole number) ✓✓