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 3.2×10^5 and 2.7×10^6 is?

A 3.02×10^6 B 8.64×10^{11}

C -2.38×10^6 D 2.37×10^{-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, 6.897×10^{-4} and 2.5×10^{-3} is the largest?

A $\frac{17}{10\,000}$ B 0.0003

C 6.897×10^{-4} D 2.5×10^{-3}

Part B (Suggested time: 25 minutes)

Show all working. **15 marks**

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11 Simplify:

a $7p + 3q - 4p + 5q$ 1 mark

b $\dfrac{9ab^2}{12a^2b}$ 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 3×10^5 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

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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 $2.4^x = 1500$
$2.4^{8.3} = 1431.3746...$
$2.4^{8.4} = 1562.335\,965...$
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 $15n^9 \div 5n^3 + 2n \times 4n^5$
$= 3n^6 + 8n^6$ ✓
$= 11n^6$ ✓

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 $h = 6$,
$r = \sqrt{\frac{3V}{\pi h}}$
$= \sqrt{\frac{3 \times 157}{\pi \times 6}}$
$= 4.998\,732\,446...$
≈ 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) ✓✓