High School Mathematics Test 2015

Year 7

Introductory Algebra

Non Calculator Section

Name_____

Skills and Knowledge Assessed:

- Introduce the concept of variables as a way of representing numbers using letters (ACMNA175)
- Extend and apply the laws and properties of arithmetic to algebraic terms and expressions (ACMNA177)
- Simplify algebraic expressions involving the four operations (ACMNA192)

Answer all questions in the spaces provided on this test paper by:

Writing the answer in the box provided.

or

Shading in the bubble for the correct answer from the four choices provided.

Show any working out on the test paper. Calculators are **not** allowed.

1. $m^5 = ?$

☐ $m + m + m + m + m$ ☐ $m \times m \times m \times m \times m$

☐ $5 + m$ ☐ $5 + m$

2. $p + p + p + p + q + q = ?$

☐ $p^4 + q^2$ ☐ $6pq$ ☐ $4p + 2q$ ☐ $p^4 q^2$

3. Ms Gausden asks her class to write an expression which is "*Four times the square of m*"
Which of these algebraic expressions could represent this?

☐ $4m^2$ ☐ $2m^4$

☐ $4 + m^2$ ☐ $\frac{m^2}{4}$

4. Simplify $5k + 3k + k$.

5. Simplify $3a \times 6d$.

6. Given that $p = 4, r = 3$ and $t = 6$, what is the value of $\frac{pr}{t}$?

☐ 1 ☐ 2 ☐ 6 ☐ 37

7. Which of these is the same as $\frac{c^2}{5}$?

☐ $(c \times c) \times 5$ ☐ $(c + c) \times 5$ ☐ $(c \times c) - 5$ ☐ $(c \times c) \div 5$

8. Which of these does **not** simplify to $12x^2y$?

☐ $3x^2 \times 4y$ ☐ $12x \times xy$

☐ $\frac{24x^2y}{2x}$ ☐ $\frac{36x^2y}{3}$

9. Simplify $8a + 7b - 3a + 8b$.

☐

10. $6qy \times 5qx = ?$

☐ $11qxy$ ☐ $11q^2xy$ ☐ $30qxy$ ☐ $30q^2xy$

11. Simplify $\frac{30m^2h}{6m}$

☐

12. Simplify $15ab - 5a^2 - 6ab - 11a^2$.

☐ $-9ab - 16a^2$ ☐ $9ab - 16a^2$ ☐ $9ab - 6a^2$ ☐ $21ab + 16a^2$

13. If $k = 5, r = 6$ and $s = 4$, what is the value of $\frac{2k + r}{s}$?

☐

14. $2z^2m \times 6zm = ?$

☐ $12z^2m^2$ ☐ $12z^3m$ ☐ $12z^3m^2$ ☐ $26z^3m^2$

15. Simplify $\frac{4a^2 \times 3ab}{6a \times b}$.

16. If a is an integer between 0 and 4 inclusive, what is the smallest value of $a^2 - 4a + 5$?

17. $4(a - 6) = ?$

☐ $4a - 6$ ☐ $4a - 10$ ☐ $4a - 2$ ☐ $4a - 24$

18. A cup holds x ml of water and a mug holds $2x + 10$ ml of water.
How much water does 3 cups and 2 mugs hold?

☐ $5x + 10$ ml ☐ $7x + 10$ ml ☐ $7x + 20$ ml ☐ $9x + 20$ ml

19. A rectangular sheet of plastic is l cm long and w cm wide. What is the combined area of 5 of these sheets?

20. Using n for the number, write an expression in algebraic symbols for the following.
"*Take any number, double it and add five, then divide the result by 10.*"

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Show any working out on this test paper. Calculators are allowed.

1. Simplify $13a - 6a + 8a$.

2. Simplify $3m + 12d - 8d - 7m$.

3. If $x = -4$, what is the value of $2x^2 + 15$?

4. $4x^2y^3 = ?$

- ☐ $4 \times x \times 2 \times y \times 3$
- ☐ $4 \times x \times x \times y \times y$
- ☐ $4 \times x \times x \times y \times y \times y$
- ☐ $4 \times 4 \times x \times x \times y \times y \times y$

5. Write $8 \times 8 \times 8 \times 8 \times 8 \times 8$ in index form.

6. If $p = 6$ and $q = -3$, what is the value of $\frac{-6p}{q^2}$?

☐ -6 ☐ -4 ☐ 4 ☐ 6

7. Write an albegraic expression for: "*Multiply the sum of x and y by 4.*"

8. $\frac{ab}{a^2 + b} = ?$

☐ $(a + b) \div (2 \times a + b)$ ☐ $(a + b) \div (a \times a + b)$
☐ $(a \times b) \div (2 \times a + b)$ ☐ $(a \times b) \div (a \times a + b)$

9. Simplify : $2 \times d \times e + 4ed - e \times d$.

10. Which of the following does **not** simplify to give $6r^2g$?

☐ $3r \times 2rg$ ☐ $r^2 \times 6g$
☐ $\frac{12r^2}{2g}$ ☐ $\frac{2(3rg)^2}{3g}$

11. If $k = 4.5$, $m = 0.3$ and $n = 0.5$, what is the value of $\frac{3k}{mn}$?

☐ 9 ☐ 22.5 ☐ 30 ☐ 90

12. Simplify $9m^3 + 7m^2 - m^3 + 6m - 12m^2 + 8m$.

☐ $8m^3 - 5m^2 + 14m$ ☐ $9m^3 - 5m^2 + 14m$
☐ $8m^3 - 19m^2 + 14m$ ☐ $10m^3 - 5m^2 + 14m$

13. When $y = 8$, $s = -5$ and $f = 6$, which expression has a value of -6.

- ☐ $\frac{ys}{f+4}$
- ☐ $\frac{3y+f}{s}$
- ☐ $ys + f$
- ☐ $y^2 + sf$

14. Simplify $\frac{2m}{3} \times \frac{9m}{4}$.

15. When $a = -6$, $b = -12$ and $c = -1$, what is the value of $\frac{a^2 + bc^3}{ac}$?

- ☐ -8
- ☐ -4
- ☐ 4
- ☐ 8

16. Simplify $\frac{3mn^2 \times 8m^2n^2}{16m^3n^3}$.

17. Which expression is not equal to $12z^2y^3$?

- ☐ $6zy \times 2y^2$
- ☐ $\frac{48z^3y^3}{4z}$
- ☐ $3y(2yz)^2$
- ☐ $\frac{(6y^2z^2)^2}{3yz^2}$

18. Given that $w = -3.8$ and $v = 6.2$, what is the value of $w(v-w)^2$?

19. Which of these means the same as $x = (y + z)^2$

- ☐ x is equal to the square of the sum of y and z.
- ☐ x is equal to twice the sum of y and z.
- ☐ x is equal to the sum of y squared and z.
- ☐ x is equal to the sum of z squared and y.

20. Which of these is always true, regardless of the values of a, b and c?

- ☐ $a + b + c = b + c - a$
- ☐ $a + (b + c) = a + b + a + c$
- ☐ $a \times (b \times c) = (a \times b) \times c$
- ☐ $a \times (b + c) = (a + b) \times (a + c)$

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Year 7 — *Introductory Algebra* — Non Calculator Section

ANSWERS

No.	WORKING	ANSWER
1.	$m^5 = m \times m \times m \times m \times m$	2nd answer
2.	$p+p+p+p+q+q = (p+p+p+p)+(q+q) = 4p + 2q$	3rd answer
3.	*Four times the square of* $m = 4 \times m^2 = 4m^2$	1st answer
4.	$5k + 3k + k = 9k$	$9k$
5.	$3a \times 6d = 18ad$	$18ad$
6.	$p = 4, r = 3$ and $t = 6$, $\frac{pr}{t} = \frac{4 \times 3}{6}$ $= \frac{12}{6}$ $= 2$	2nd answer
7.	$\frac{c^2}{5} = \frac{c \times c}{5}$ $= (c \times c) \div 5$	4th answer
8.	$\frac{24x^2y}{2x} = 12xy \neq 12x^2y$ The rest are equal to $12x^2y$	3rd answer
9.	$8a + 7b - 3a + 8b = 8a - 3a + 7b + 8b$ $= 5a + 15b$	$5a + 15b$

<table>
<tr><td>10.</td><td>$6qy \times 5qx = 5 \times 6 \times q \times q \times x \times y$
$= 30q^2xy$</td><td>4th answer</td></tr>
<tr><td>11.</td><td>$\frac{30m^2h}{6m} = 5mh$</td><td>$5mh$</td></tr>
<tr><td>12.</td><td>$15ab - 5a^2 - 6ab - 11a^2 = 9ab - 16a^2$</td><td>2nd answer</td></tr>
<tr><td>13.</td><td>$k = 5, r = 6$ and $s = 4$,
$\frac{2k+r}{s} = \frac{2 \times 5 + 6}{4}$
$= \frac{16}{4}$
$= 4$</td><td>4</td></tr>
<tr><td>14.</td><td>$2z^2m \times 6zm = 12z^3m^2$</td><td>3rd answer</td></tr>
<tr><td>15.</td><td>$\frac{4a^2 \times 3ab}{6a \times b} = \frac{12a^3b}{6ab}$
$= 2a^2$</td><td>$2a^2$</td></tr>
<tr><td>16.</td><td><table><tr><th>a</th><th>$a^2 - 4a + 5$</th></tr><tr><td>0</td><td>$0^2 - 4 \times 0 + 5 = 0 + 0 + 5 = 5$</td></tr><tr><td>1</td><td>$1^2 - 4 \times 1 + 5 = 1 - 4 + 5 = 2$</td></tr><tr><td>2</td><td>$2^2 - 4 \times 2 + 5 = 4 - 8 + 5 = 1$</td></tr><tr><td>3</td><td>$3^2 - 4 \times 3 + 5 = 9 - 12 + 5 = 2$</td></tr><tr><td>4</td><td>$4^2 - 4 \times 4 + 5 = 16 - 16 + 5 = 5$</td></tr></table>The smallest value is 1</td><td>1</td></tr>
<tr><td>17.</td><td>$4(a-6) = 4 \times (a-6)$
$= 4 \times a - 4 \times 6$
$= 4a - 24$</td><td>4th answer</td></tr>
</table>

18.	Amount that 3 cups and 2 mugs hold $= 3 \times x + 2 \times (2x + 10)$ $= 3x + 4x + 20$ $= 7x + 20$ ml	3rd answer
19.	Area of 1 sheet $= l \times w =$ lw Area of 5 sheets $= lw \times 5$ $= 5lw$	$5lw$
20.	"*Take any number (n)* *Double it gives 2n* *Add five, gives 2n + 5* *Divide the result by 10 gives* $\frac{2n + 5}{10}$	$\frac{2n + 5}{10}$

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ANSWERS

No.	WORKING	ANSWER
1.	$13a - 6a + 8a. = 7a + 8a = 15a$	$15a$
2.	$3m + 12d - 8d - 7m. = 3m - 7m + 12d - 8d$ $= -4m + 4d$	$-4m + 4d$
3.	$2x^2 + 15 = 2 \times (-4)^2 + 15$ $= 2 \times 16 + 15$ $= 32 + 15$ $= 47$	47
4.	$4x^2y^3 = 4 \times x \times x \times y \times y \times y$	3rd answer
5.	$8 \times 8 \times 8 \times 8 \times 8 \times 8 = 8^6$	8^6
6.	$\frac{-6p}{q^2} = \frac{-6 \times 6}{(-3)^2}$ $= \frac{-36}{9}$ $= -4$	2nd answer
7.	"*Multiply the sum of x and y by 4.*" *The sum of x and y* = $x + y$ *Multiply this by 4* = $4 \times (x + y) = 4(x + y)$	$4 \times (x + y)$ or $4(x + y)$
8.	$\frac{ab}{a^2 + b} = (a \times b) \div (a \times a + b)$	4th answer

9.	$2 \times d \times e + 4ed - e \times d = 2ed + 4ed - ed$ $= 5ed$	$5ed$ or $5de$
10.	$3r \times 2rg = 6r^2g$ $r^2 \times 6g = 6r^2g$ $\frac{12r^2}{2g} = \frac{6r^2}{g} \neq 6r^2g$ $\frac{2(3rg)^2}{3g} = \frac{2 \times 9r^2g^2}{3g} = \frac{18r^2g^2}{3g} = 6r^2g$	3rd answer
11.	$k = 4.5, m = 0.3$ and $n = 0.5$ $\frac{3k}{mn} = \frac{3 \times 4.5}{0.3 \times 0.5} = \frac{13.5}{0.15} = 90$	4th answer
12.	$9m^3 + 7m^2 - m^3 + 6m - 12m^2 + 8m = 9m^3 - m^3 + 7m^2 - 12m^2$ $= 8m^3 - 5m^2 + 14m$	1st answer
13.	$y = 8$, $s = -5$ and $f = 6$ $\frac{ys}{f+4} = \frac{8 \times -5}{6+4} = \frac{-40}{10} = -4$ $\frac{3y+f}{s} = \frac{3 \times 8 + 6}{-5} = \frac{30}{-5} = -6$ $ys + f = 8 \times (-5) + 6 = -40 + 6 = -34$ $y^2 + sf = 8^2 + (-5) \times 6 = 64 - 30 = 34$	2nd answer
14.	$\frac{2m}{3} \times \frac{9m}{4} = \frac{18m^2}{12} = \frac{3m^2}{2}$	$\frac{3m^2}{2}$

15.	When $a = -6$, $b = -12$ and $c = -1$, $\frac{a^2 + bc^3}{ac} = \frac{(-6)^2 + (-12) \times (-1)^3}{(-6) \times (-1)}$ $= \frac{36 + (-12) \times (-1)}{6}$ $= \frac{36 + 12}{6}$ $= \frac{48}{6}$ $= 8$	4th answer
16.	$\frac{3mn^2 \times 8m^2n^2}{16m^3n^3} . = \frac{24m^3n^4}{16m^3n^3}$ $= \frac{3n}{2}$	$\frac{3n}{2}$
17.	$6zy \times 2y^2 = 12zy^3 \neq 12z^2y^3$ $\frac{48z^3y^3}{4z} = 12z^2y^3$ $3y(2yz)^2 = 3y(4y^2z^2) = 12z^2y^3$ $\frac{(6y^2z^2)^2}{3yz^2} = \frac{36y^4z^4}{3yz^2} = 12z^2y^3$	1st answer
18.	Given that $w = -3.8$ and $v = 6.2$, $w(v - w)^2 = -3.8 \times (6.2 - (-3.8))^2$ $= -3.8 \times (6.2 + 3.8)^2$ $= -3.8 \times (10)^2$ $= -3.8 \times 100$ $= -380$	–380
19.	x is equal to the square of the sum of y and z $\Rightarrow$ $x = (y + z)^2$ x is equal to twice the sum of y and z $\Rightarrow$ $x = 2(y + z)$ x is equal to the sum of y squared and z $\Rightarrow$ $x = y^2 + z$ x is equal to the sum of z squared and y $\Rightarrow$ $x = z^2 + y$	1st answer

20.	$a + b + c = b + c - a$ is not true e.g. $3 + 4 + 5 \neq 4 + 5 - 3$ $12 \neq 6$ $a + (b + c) = a + b + a + c$ is not true e.g. $3 + (4 + 5) \neq 3 + 4 + 3 + 5$ $12 \neq 15$ $a \times (b \times c) = (a \times b) \times c$ is true e.g. $3 \times (4 \times 5) = (3 \times 4) \times 5$ $3 \times 20 = 12 \times 5$ Can be shown to be true for any three numbers $a \times (b + c) = (a + b) \times (a + c)$ is not true e.g. $3 \times (4 + 5) \neq (3 + 4) \times (3 + 5)$ $3 \times 9 \neq 7 \times 8$ $27 \neq 56$	3rd answer