SIMPLIFYING AND PROVING ALGEBRICALLY

Pearson Edexcel – Monday 8 June 2020 - Paper 3 (Calculator) Higher Tier

1.

15 Prove algebraically that $0.7\dot{3}$ can be written as $\frac{11}{15}$

(Total for Question 15 is 2 marks)

Pearson Edexcel - Thursday 6 June 2019 - Paper 2 (Calculator) Higher Tier

2.

13 Show that $6 + \left[(x + 5) \div \frac{x^2 + 3x - 10}{x - 1} \right]$ simplifies to $\frac{ax - b}{cx - d}$ where a, b, c and d are integers.

(Total for Question 13 is 4 marks)

Pearson Edexcel - Tuesday 6 November 2018 - Paper 1 (Non-Calculator) Higher Tier

3.

16 Prove algebraically that $0.2\dot{5}\dot{6}$ can be written as $\frac{127}{495}$

(Total for Question 16 is 3 marks)

Pearson Edexcel - Monday 12 November 2018 - Paper 3 (Calculator) Higher Tier

4.

15 Prove algebraically that the difference between the squares of any two consecutive odd numbers is always a multiple of 8

(Total for Question 15 is 3 marks)

Pearson Edexcel - Thursday 2 November 2017 - Paper 1 (Non-Calculator) Higher Tier

5.

15 $x = 0.4\dot{3}\dot{6}$

Prove algebraically that x can be written as $\frac{24}{55}$

(Total for Question 15 is 3 marks)

Pearson Edexcel - Thursday 2 November 2017 - Paper 1 (Non-Calculator) Higher Tier

6.

17 n is an integer.

Prove algebraically that the sum of $\frac{1}{2}n(n+1)$ and $\frac{1}{2}(n+1)(n+2)$ is always a square number.

(Total for Question 17 is 2 marks)

Pearson Edexcel - Wednesday 8 November 2017 - Paper 3 (Calculator) Higher Tier

7.

19 Prove algebraically that the straight line with equation $x - 2y = 10$ is a tangent to the circle with equation $x^2 + y^2 = 20$

(Total for Question 19 is 5 marks)

Pearson Edexcel - Thursday 8 June 2017 - Paper 2 (Calculator) Higher Tier

8.

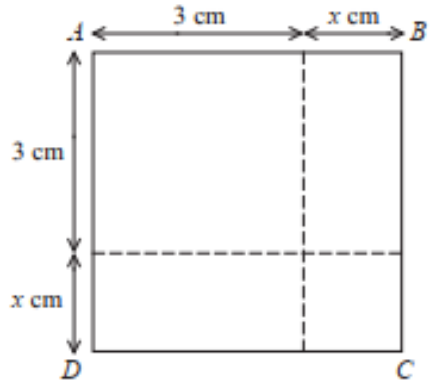
16 Using algebra, prove that $0.1\dot{3}\dot{6} \times 0.\dot{2}$ is equal in value to $\frac{1}{33}$

(Total for Question 16 is 3 marks)

Pearson Edexcel - Thursday 25 May 2017 - Paper 1 (Non-Calculator) Higher Tier

9.

4



The area of square $ABCD$ is 10 cm^2.

Show that $x^2 + 6x = 1$

(Total for Question 4 is 3 marks)

Pearson Edexcel - Thursday 25 May 2017 - Paper 1 (Non-Calculator) Higher Tier

10.

16 n is an integer greater than 1

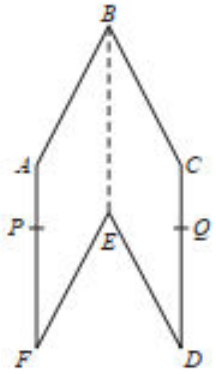
Prove algebraically that $n^2 - 2 - (n - 2)^2$ is always an even number.

(Total for Question 16 is 4 marks)

Pearson Edexcel - Thursday 25 May 2017 - Paper 1 (Non-Calculator) Higher Tier

11.

22 The diagram shows a hexagon $ABCDEF$.



$ABEF$ and $CBED$ are congruent parallelograms where $AB = BC = x$ cm.
P is the point on AF and Q is the point on CD such that $BP = BQ = 10$ cm.

Given that angle $ABC = 30°$,

prove that $\cos PBQ = 1 - \frac{(2-\sqrt{3})}{200}x^2$

(Total for Question 22 is 5 marks)

Pearson Edexcel - Specimen Papers Set 2 - Paper 3 (Calculator) Higher Tier

12.

17 The product of two consecutive positive integers is added to the larger of the two integers.

Prove that the result is always a square number.

(Total for Question 17 is 3 marks)

Pearson Edexcel - Specimen Papers Set 2 - Paper 3 (Calculator) Higher Tier

13.

19 Prove algebraically that the recurring decimal $0.3\dot{1}\dot{8}$ can be written as $\frac{7}{22}$

(Total for Question 19 is 2 marks)

Pearson Edexcel - Specimen Papers Set 1 - Paper 1 (Non-Calculator) Higher Tier

14.

20 Prove algebraically that the difference between the squares of any two consecutive integers is equal to the sum of these two integers.

(Total for Question 20 is 4 marks)

Pearson Edexcel - Specimen Papers Set 1 - Paper 2 (Calculator) Higher Tier

15.

13 Show that

$$(3x - 1)(x + 5)(4x - 3) = 12x^3 + 47x^2 - 62x + 15$$

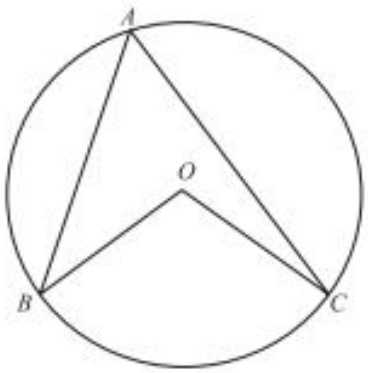
for all values of x.

(Total of Question 13 is 3 marks)

Pearson Edexcel - Specimen Papers Set 1 - Paper 2 (Calculator) Higher Tier

16.

24 A, B and C are points on the circumference of a circle centre O.



Prove that angle BOC is twice the size of angle BAC.

(Total for Question 24 is 4 marks)

Pearson Edexcel - Sample Paper 2 - (Calculator) Higher Tier

17.

14 Prove algebraically that

$$(2n + 1)^2 - (2n + 1) \text{ is an even number}$$

for all positive integer values of n.

(Total for Question 14 is 3 marks)

Pearson Edexcel - Sample Paper 2 - (Calculator) Higher Tier

18.

15 Prove algebraically that the recurring decimal $0.2\dot{5}$ has the value $\frac{23}{90}$

(Total for Question 15 is 2 marks)

Pearson Edexcel - Thursday 4 June 2015 - Paper 1 (Non-Calculator) Higher Tier

19.

21 $x = 0.0\dot{4}\dot{5}$

Prove algebraically that x can be written as $\frac{1}{22}$

(Total for Question 21 is 3 marks)

Pearson Edexcel - Monday 8 June 2015 - Paper 2 (Calculator) Higher Tier

20.

20 Show that $(n + 3)^2 - (n - 3)^2$ is an even number for all positive integer values of n.

(Total for Question 20 is 3 marks)

Pearson Edexcel - Friday 13 June 2014 - Paper 2 (Calculator) Higher Tier

21.

21 (a) Expand and simplify $(y - 2)(y - 5)$

.....

(2)

*(b) Prove algebraically that

$(2n + 1)^2 - (2n + 1)$ is an even number

for all positive integer values of n.

(3)

(Total for Question 21 is 5 marks)

Pearson Edexcel - Thursday 28 February 2013 - Paper 1 (Non-Calculator) Higher Tier

22.

'21 Prove algebraically that the difference between the squares of any two consecutive integers is equal to the sum of these two integers.

(Total for Question 21 is 4 marks)

Pearson Edexcel - Thursday 8 November 2012 - Paper 2 (Calculator) Higher Tier

23.

*25 The diagram shows the triangle PQR.

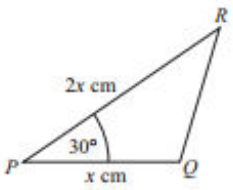


Diagram **NOT** accurately drawn

$PQ = x$ cm
$PR = 2x$ cm
Angle $QPR = 30°$

The area of triangle $PQR = A$ cm²

Show that $x = \sqrt{2A}$

(Total for Question 25 is 3 marks)

Pearson Edexcel - Wednesday 13 June 2012 - Paper 2 (Calculator) Higher Tier

24.

21 Prove that

$$(2n + 3)^2 - (2n - 3)^2 \text{ is a multiple of } 8$$

for all positive integer values of n.

(Total for Question 21 is 3 marks)

Pearson Edexcel - Thursday 5 November 2009 - Paper 3 (Non-Calculator) Higher Tier

25.

23. Prove that the recurring decimal $0.\dot{3}\dot{6} = \frac{4}{11}$

(Total 3 marks)

Pearson Edexcel - Thursday 5 November 2009 - Paper 3 (Non-Calculator) Higher Tier

26.

25. Prove, using algebra, that the sum of two consecutive whole numbers is always an odd number.

(Total 3 marks)

OCR GSCE – Thursday 5 November 2020 – Paper 5 (Non-Calculator) Higher Tier

27.

14 Simplify.

(a) $4a^{\frac{1}{2}} \times 3a^{2}$

(a) ..... **[2]**

(b) $\left(\frac{2a^{2}}{a^{-3}}\right)^{3}$

(b) ..... **[3]**

OCR GSCE – Tuesday 5 November 2019 – Paper 4 (Calculator) Higher Tier

28.

5 Multiply out and simplify.

$(4x + y)(x - 3y)$

..... **[3]**

OCR GSCE – Thursday 7 November 2019 – Paper 5 (Non-Calculator) Higher Tier

29.

3 Martina has answered some questions on algebra.
In each question, she has made an error.

Describe her error and give the correct answer to each problem.

(a) Question 1 Simplify. $2a \times a \times a$

Martina's answer $4a$

Martina's error is .....

.....

Correct answer = ... **[2]**

(b) Question 2 Simplify. $\frac{x^{10}}{x^2}$

Martina's answer x^5

Martina's error is .....

.....

Correct answer = ... **[2]**

(c) Question 3 $s = ut + \frac{1}{2}at^2$

Find s when $u = 0$, $t = 5$ and $a = 6$.

Martina's solution $s = 0 \times 5 + \frac{1}{2} \times 6 \times 5^2$

$s = 0 + 15^2$

$s = 225$

Martina's error is .....

.....

Correct answer = ... **[2]**

OCR GSCE – Thursday 6 June 2019 – Paper 5 (Non-Calculator) Higher Tier

30.

2 **(a)** Simplify fully.

$$\frac{3a^8 \times 2a^5}{a^2}$$

(a) ..... **[3]**

(b) Solve.

$$\frac{6x - 10}{5} = 1$$

(b) $x =$ ..... **[3]**

OCR GSCE – Thursday 6 June 2019 – Paper 5 (Non-Calculator) Higher Tier

31.

11 **(a)** Simplify fully.

$\sqrt{200}$

(a) ..... **[2]**

(b) Evaluate.

$8^{\frac{1}{3}}$

(b) ..... **[1]**

OCR GSCE – Tuesday 2 November 2017 – Paper 4 (Calculator) Higher Tier

32.

2 **(a)** Simplify.

(i) $a^6 \div a^2$

(a)(i) ..... **[1]**

(ii) $(b^5)^3$

(ii) ..... **[1]**

(b) Factorise.

$6x - x^2$

(b) ..... **[1]**

OCR GSCE – Tuesday 2 November 2017 – Paper 4 (Calculator) Higher Tier

33.

13 (a) Solve.

$$x^2 - 6x + 15 = 3x - 5$$

(a) $x =$ ..... or $x =$ ..... **[4]**

(b) Expand and simplify.

$$(2x - 1)(x + 5)(3x - 2)$$

(b) ..... **[4]**

OCR GSCE – Tuesday 6 November 2017 – Paper 5 (Non - Calculator) Higher Tier

34.

18 Prove that the difference between two consecutive square numbers is always odd. **[4]**

OCR GSCE – Thursday 8 June 2017 – Paper 5 (Non - Calculator) Higher Tier

35.

15 (a) Simplify fully.

(i) $\sqrt{50} + \sqrt{2}$

(a)(i) ..... **[2]**

(ii) $\frac{10}{\sqrt{6}}$

(ii) ..... **[2]**

(b) There are two errors in Sam's method for finding the value of $64^{-\frac{2}{3}}$ shown below.

Find the cube root of 64 and then multiply by 2.
The cube root of 64 is 4 and then 4 x 2 = 8.
The negative power makes the answer negative so answer equals -8.

Describe these errors and then give the correct value of $64^{-\frac{2}{3}}$.

.....

.....

Correct value ..... **[3]**

OCR GSCE – Tuesday 13 June 2017 – Paper 6 (Calculator) Higher Tier

36.

16 **(a)** Simplify.

$$\frac{3y^3}{y^{-4}}$$

(a) ..... **[1]**

(b) Write as a single fraction in its simplest form.

$$\frac{3}{x-1}+\frac{4}{x+2}$$

(b) ..... **[3]**

OCR GSCE – Sample Papers – Paper 4 (Calculator) Higher Tier

37.

20 **(a)** Express as a single fraction.

$$\frac{m+1}{n+1} - \frac{m}{n}$$

Simplify your answer.

(a) ..... **[2]**

(b) Using your answer to part **(a)**, prove that if m and n are positive integers and $m < n$, then

$$\frac{m+1}{n+1} - \frac{m}{n} > 0.$$ **[2]**

AQA GSCE – Tuesday 19 May 2020 – Paper 1 (Non - Calculator) Higher Tier

38.

13 (a) s and t are **positive** integers.

$(x + s)(x - t)$ is expanded and simplified.

The answer is $x^2 + kx - 40$ where k is a positive integer.

Work out the **smallest** possible value of k.

[2 marks]

Answer _____

13 (b) Faisal tries to solve $(x + 2)(x - 7) = 0$

Here is his working.

	$(x + 2) = 0$	or	$(x - 7) = 0$
Answer	$x = 2$	or	$x = 7$

Give a reason why his answer is wrong.

[1 mark]

AQA GSCE – Thursday 8 June 2020 – Paper 3 (Calculator) Higher Tier

39.

26 Prove algebraically that $3.4\dot{7} = \frac{313}{90}$

[3 marks]

AQA GSCE – Tuesday 21 May 2019 – Paper 1 (Non - Calculator) Higher Tier

40.

16 Simplify fully $\frac{4x - 8x^2}{12x - 6}$

[3 marks]

Answer _____

AQA GSCE – Tuesday 11 June 2019 – Paper 3 (Calculator) Higher Tier

41.

15 Simplify fully $\frac{a^3b^2}{cd} \times \frac{c}{ab^5}$

[3 marks]

Answer _____

AQA GSCE – Tuesday 6 November 2018 – Paper 1 (Non - Calculator) Higher Tier

42.

3 Simplify $16a^2 \div a + 3a \times 2$

Circle your answer.

[1 mark]

$22a$ $8a$ $38a$ $2a$

AQA GSCE – Thursday 8 November 2018 – Paper 2 (Calculator) Higher Tier

43.

20 n is a positive integer.

Prove algebraically that $2n^2\left(\frac{3}{n} + n\right) + 6n\left(n^2 - 1\right)$ is a cube number.

[3 marks]

AQA GSCE – Thursday 8 November 2018 – Paper 2 (Calculator) Higher Tier

44.

22 Simplify fully $\frac{x^5 - 4x^3}{3x - 6}$

[3 marks]

Answer _____

AQA GSCE – Monday 24 May 2018 – Paper 1 (Non - Calculator) Higher Tier

45.

3 Circle the expression that is equivalent to $3a - a \times 4a + 2a$

[1 mark]

$8a^2 + 2a$ $12a^2$ $5a - 4a^2$ $3a - 6a^2$

AQA GSCE – Thursday 7 June 2018 – Paper 2 (Calculator) Higher Tier

46.

13 Show that, for $x \neq -1$

$$\frac{8x^2 - 8}{4x + 4}$$ simplifies to the form $ax + b$ where a and b are integers.

[3 marks]

AQA GSCE – Thursday 7 June 2018 – Paper 2 (Calculator) Higher Tier

47.

27 Prove algebraically that $2.7\dot{5}$ converts to the fraction $\frac{124}{45}$

[3 marks]

AQA GSCE – Sample Paper 2 (Calculator) Higher Tier

48.

3 Circle the expression that is equivalent to $2a + 5a \times 4a - a$

[1 mark]

$a + 20a^2$ $21a^2$ $28a^2 - a$ $2a + 15a^2$

AQA GSCE – Tuesday 12 June 2018 – Paper 3 (Calculator) Higher Tier

48.

18 Show that, for $x \neq 0$

$$\frac{x+4}{3x} - \frac{5}{2x}$$

can be written in the form $\frac{ax+b}{cx}$ where a, b and c are integers.

[3 marks]

Answer _____

AQA GSCE – Thursday 6 November 2017 – Paper 2 (Calculator) Higher Tier

49.

11 Circle the expression that is equivalent to $\frac{3x^2}{6x^2+3}$

[1 mark]

$\frac{x^2}{2x^2+3}$ $\frac{x^2}{6x^2+1}$ $\frac{x^2}{2x^2+1}$ $\frac{1}{2}+x^2$

AQA GSCE – Wednesday 8 November 2017 – Paper 3 (Calculator) Higher Tier

50.

5 Multiply out and simplify $(x-8)^2$

[2 marks]

Answer _____

AQA GSCE – Wednesday 25 May 2017 – Paper 1 (Non - Calculator) Higher Tier

51.

1 Simplify $2^5 \times 2^3$

Circle your answer.

[1 mark]

4^8 2^8 2^{15} 4^{15}

AQA GSCE – Tuesday 13 June 2017 – Paper 3 (Calculator) Higher Tier

52.

27 Prove that $x^2 + x + 1$ is always positive.

[3 marks]

AQA GSCE – Sample Paper 1 (Non - Calculator) Higher Tier

53.

26 Rationalise the denominator and simplify $\frac{10}{3\sqrt{5}}$

[2 marks]

Answer _____