3.13 Substitution: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Work out the value of 3x + 4 when x = 2.

(Total for Question 1 is 1 mark)

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2 A small packet of crisps contains m grams of crisps. The energy E in kilocalories is given by E = 5m. How many kilocalories are in a packet with mass 30 g? Give your answer.

(Total for Question 2 is 2 marks)

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3 Evaluate 7 - 2x when x = -1.

(Total for Question 3 is 2 marks)

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4 Use the formula A = (1/2)h(a + b) to work out the value of A when h = 20, a = -4, b = 14.

(Total for Question 4 is 3 marks)

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5 Work out the value of $3n^2 + 3n - 1$ when $n = -1$.

(Total for Question 5 is 3 marks)

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6 A toy car travels at speed v given by $v = d / t$ where d is distance in metres and t is time in seconds. Find v when $d = 150$ m and $t = 15$ s. Give the unit.

(Total for Question 6 is 4 marks)

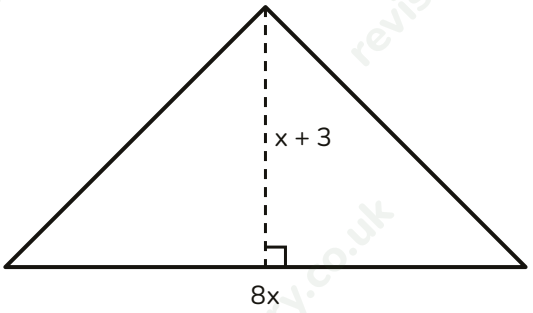
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7 Substitute $x = 3$ and $y = -2$ into the expression $5x - 2y$ and simplify.

(Total for Question 7 is 2 marks)

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8 A formula for the area A of an isosceles triangle is A = (1/2)bh where b is the base and h is the height. A triangle has b = 8x and h = x + 3. Write an expression for A in terms of x and simplify fully.



(Total for Question 8 is 3 marks)

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9 $H(p) = p^2 - 6p + 8$. Given $p = 3 + 2t$, expand H(p) fully in terms of t and simplify.

(Total for Question 9 is 5 marks)

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10 Show that if $f(x) = ax + b$ and $g(x) = 2x - 5$, then the composite function f(g(x)) equals 2.5 when x = 3, given a = 2 and b = 0.5. You must show substitution and evaluation.

(Total for Question 10 is 6 marks)

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11 A scientist models mass m (in kg) by $m = c\ r^2$ where c is a constant and r is the radius in metres. Given $c = 0.75$ and $r = 2k + 1$ where $k = 2$, find m and give your answer in the form a/b or simplified fraction where appropriate.

(Total for Question 11 is 8 marks)

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12 Given the expression $E = (2x + 1)/(x - 1)$. Show that $E = 5$ when $x = 2$. Then find the value of x (if any) for which $E = 2$. You must show all algebraic steps.

(Total for Question 12 is 7 marks)

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Mark scheme · 3.13 Substitution: Test Pack

Question 1

10 cao	**B1**

Answer: 10

Question 2

substitute m = 30 into E = 5m	**M1**
150 kcal cao	**A1**

Answer: 150 kilocalories

Question 3

substitute x = -1 and show 7 - 2 x (-1) or equivalent method	**M1**
9 cao	**A1**

Answer: 9

Question 4

correct substitution	**M1**
correct evaluation of a term or the powers	**M1**
100	**A1**

Answer: 100

Question 5

squares -1 correctly: 1	**M1**
complete substitution	**M1**
-1	**A1**

Answer: -1

Question 6

substitute d = 150 and t = 15 into v = d / t	**M1**
perform division 150 / 15 or show equivalent	**M1**
10 cao	**A1**
correct unit m/s stated	**B1**

Answer: 10 m/s

Question 7

substitute values: 5*3 - 2*(-2) or equivalent	**M1**
19 cao	**A1**

Answer: 19

Question 8

substitute A = (1/2) * 8x * (x+3) or show (1/2)*8x*(x+3)	**M1**
simplify (1/2)*8x*(x+3) to 4x(x+3) or show distribution step	**M1**
$4x^2 + 12x$ cao	**A1**

Answer: $4x^2 + 12x$

Question 9

substitute p = 3+2t into $p^2 - 6p + 8$	**M1**
expand $(3+2t)^2 = 9 + 12t + 4t^2$	**M1**
expand -6(3+2t) = -18 -12t	**M1**
collect terms correctly	**M1**
$4t^2 - 1$ cao	**A1**

Answer: $4t^2 - 1$

Question 10

state g(x)=2x-5 and substitute into f: f(g(x)) = a(2x-5)+b	**M1**
substitute a=2 and b=0.5 to get 2(2x-5)+0.5	**M1**
simplify to 4x - 10 + 0.5 = 4x - 9.5	**M1**
substitute x=3 to evaluate: 4*3 - 9.5	**M1**
calculate 12 - 9.5 = 2.5	**M1**
state final evaluation equals 2.5 cao, confirming the given target value	**A1**

Answer: 2.5

Question 11

substitute k = 2 into r = 2k + 1 to get r = 5	**M1**
state $m = c r^2$ and substitute r: $m = 0.75 * 5^2$	**M1**
compute $r^2 = 25$	**M1**
compute 0.75 * 25 = 18.75	**M1**
convert 0.75 to fraction 3/4 and show 3/4 * 25	**M1**
compute fraction 3/4 * 25 = 75/4	**M1**
simplify fraction if needed and include units	**M1**
75/4 kg cao	**A1**

Answer: 75/4 kg or 18.75 kg

Question 12

substitute x = 2: (2*2 + 1)/(2 - 1) = (4 + 1)/1	**M1**
calculate numerator and denominator to show 5/1 = 5	**M1**
for E = 2, multiply both sides by (x - 1): 2x + 1 = 2(x - 1)	**M1**
expand and rearrange to show contradiction: 2x + 1 = 2x - 2 gives 1 = -2	**M1**
state domain restriction $x \neq 1$ or note that x = 1 would make denominator zero	**B1**
deduce from 1 = -2 that no solution exists	**M1**
conclude there is no value of x satisfying E = 2, cao	**A1**

Answer: E = 5 when x = 2. There is no solution for E = 2 (contradiction 1 = -2), with $x \neq 1$ noted.

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