Cambridge Assessment
Admissions Testing

# TEST OF MATHEMATICS FOR UNIVERSITY ADMISSION

D513/11

model answers

## PAPER 1

**Wednesday 31 October 2018**

Time: 75 minutes

Additional materials: Answer sheet

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**INSTRUCTIONS TO CANDIDATES**

**Please read these instructions carefully, but do not open the question paper until you are told that you may do so.**

A separate answer sheet is provided for this paper. Please check you have one. You also require a soft pencil and an eraser.

This paper is the first of two papers.

There are 20 questions on this paper. For each question, choose the one answer you consider correct and record your choice on the separate answer sheet. If you make a mistake, erase thoroughly and try again.

There are no penalties for incorrect responses, only marks for correct answers, so you should attempt **all** 20 questions. Each question is worth one mark.

Any rough work should be done on this question paper. No extra paper is allowed.

Please complete the answer sheet with your candidate number, centre number, date of birth, and full name.

Calculators and dictionaries must **NOT** be used.

There is no formulae booklet for this test.

**Please wait to be told you may begin before turning this page.**

This question paper consists of 21 printed pages and 3 blank pages.

PV1

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$\frac{3-2x}{x\sqrt{x}} = \frac{x\sqrt{x}(3-2x)}{x^2 x} = \frac{x\sqrt{x}(3-2x)}{x^3} = \frac{\sqrt{x}(3-2x)}{x^2} = \frac{x^{1/2}(3-2x)}{x^2}$

$= \frac{3x^{1/2} - 2x^{3/2}}{x^2}$

$= 3x^{-3/2} - 2x^{-1/2}$

**1** Find the value of

$$\int_1^4 \frac{3-2x}{x\sqrt{x}}\,\mathrm{d}x$$

**A** $-\frac{13}{2}$

**B** $-\frac{85}{16}$

**C** $-\frac{13}{8}$

**D** $-1$

**E** $-\frac{1}{4}$

**F** $\frac{7}{4}$

**G** $7$

$= \int_1^4 3x^{-3/2} - 2x^{-1/2}\,dx = \frac{-3x^{-1/2}}{1/2} - \frac{2x^{1/2}}{1/2}\Big|_1^4$

$= -6x^{-1/2} - 4x^{1/2}\Big|_1^4$

$= \left(-6\left(\frac{1}{\sqrt{4}}\right) - 4\sqrt{4}\right) - \left(-6\left(\frac{1}{\sqrt{1}}\right) - 4\sqrt{1}\right)$

$= (-3-8) - (-6-4)$

$= -11 - -10$

$= -1$

Sum of an AP $= \frac{n}{2}(2a + (n-1)d)$

we have a and d, & are told $S_5 = S_8$

**2** An arithmetic progression has first term $a$ and common difference $d$.

The sum of the first 5 terms is equal to the sum of the first 8 terms.

Which one of the following expresses the relationship between $a$ and $d$?

**A** $a = -\frac{38}{3}d$

**B** $a = -7d$

**C** $a = -6d$

**D** $a = 6d$

**E** $a = 7d$

**F** $a = \frac{38}{3}d$

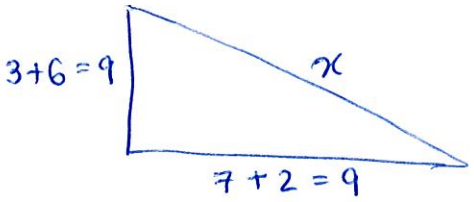
$S_5 = \frac{5}{2}(2a + 4d) = 2.5(2a + 4d) = 5a + 10d$

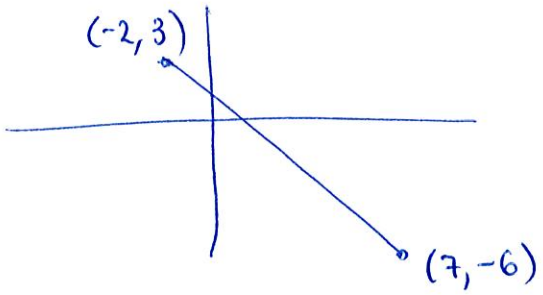
$S_8 = \frac{8}{2}(2a + 7d) = 4(2a + 7d) = 8a + 28d$

Since $S_5 = S_8$ we get $5a + 10d = 8a + 28d$

$-3a = 18d$

$a = -6d$




**3** Find the shortest distance between the two circles with equations:

$(x+2)^2 + (y-3)^2 = 18$ centre $(-2, 3)$ & radius $3\sqrt{2}$

$(x-7)^2 + (y+6)^2 = 2$ centre $(7, -6)$ & radius $\sqrt{2}$

**A** 0

**B** 4

**C** 16

**D** $2\sqrt{2}$

**E** $5\sqrt{2}$

$x^2 = 9^2 + 9^2 = 162 \Rightarrow x = \sqrt{162} = 9\sqrt{2}$

Sum of radii of both circles $= 3\sqrt{2} + \sqrt{2} = 4\sqrt{2}$

$\therefore$ shortest distance between circumferences is

$9\sqrt{2} - 4\sqrt{2} = 5\sqrt{2}$

$3x^2 + 2xy = 4$

$3x^2 + 2ax - 2x^2 = 4$

$x^2 + 2ax = 4$

$x^2 + 2ax - 4 = 0$

**4** Consider the simultaneous equations

$$3x^2 + 2xy = 4$$

$$x + y = a \Rightarrow y = a - x$$

where $a$ is a real constant.

Find the complete set of values of $a$ for which the equations have two distinct real solutions for $x$.

**A** There are no values of $a$.

**B** $-2 < a < 2$

**C** $-1 < a < 1$

**D** $a = 0$

**E** $a < -1$ or $a > 1$

**F** $a < -2$ or $a > 2$

**G** All real values of $a$

Discriminant $= 4a^2 + 16 > 0$

$\therefore$ 2 distinct solutions & is OK for all A