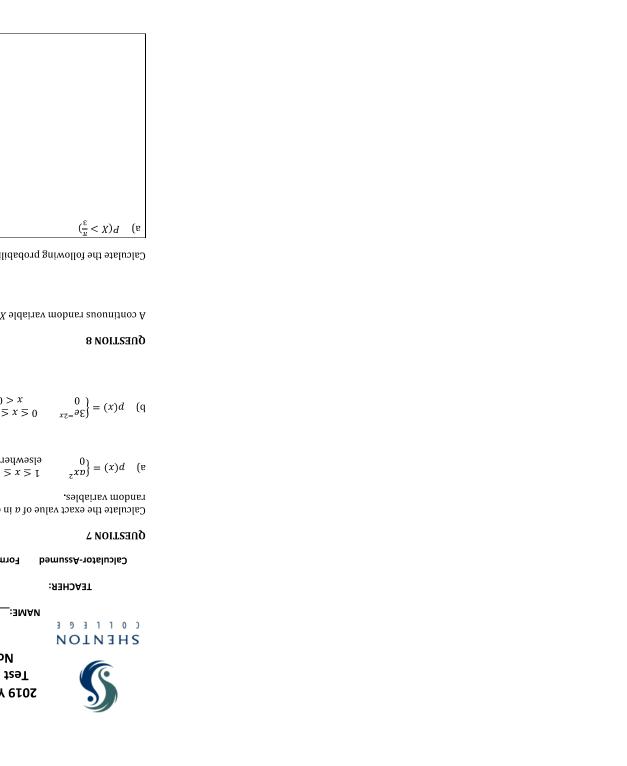
2019 YEAR 12 MATHEMATICS: METHODS Test 3 (Continuous Random Variables, Normal Distribution, Logarithms)

	$(\frac{\pi}{9} - \langle X \frac{\pi}{4} \rangle X) d$	(q		$(\frac{\varepsilon}{u} < X)d$	9)	
Calculate the following probabilities correct to four decimal places.						
[3 marks - 1, 2]	A continuous random variable X , as the probability density function given by $p(x) = \begin{cases} \frac{1}{2} \cos x & -\frac{\pi}{2} \le x \le \frac{\pi}{2} \\ 0 & \text{elsewhere} \end{cases}$					
				8 NOITS	IUQ	
		r	0 > x $0 > x > 0$		(q	
			$1 \le x \le 3$	${0 \brace z x v} = (x)d$	(6	
Calculate the exact value of a in each of the following probability density functions of continuous random variables.						
				7 NOITS	ług	
Marks: 37 marks	Working time: 25 minutes	ula sheet provided	med Form	ussA-rotaluslaS		
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QUESTION 9

[10 marks - 2, 2, 2, 2, 2]

A continuous random variable *X* has a probability density function given by

$$f(x) = \begin{cases} \frac{1}{4}(2x+1) & 1 \le x \le 2\\ 0 & \text{elsewhere} \end{cases}$$

a) Calculate the mean of X.

b) Calculate the standard deviation of *X*.

c) Calculate the median of X.

d) State the cumulative distribution function, F(x).

e) Show how you would use the cumulative distribution function to calculate P(1.2 < X < 1.7).

QUESTION 10

[3 marks - 1, 2]

The heights of 50 Year 12 students are displayed in the table below.

Height (cm)	Frequency	
x x		
$140 \le x < 150$	2	
$150 \le x < 160$	10	
$160 \le x < 170$	19	
$170 \le x < 180$	15	
$180 \le x < 190$	3	
$190 \le x < 200$	1	

Use the data in the table to calculate the following probabilities.

a)
$$P(160 < X < 180)$$

b)
$$P(X < 150 | X < 170)$$

QUESTION 11

[5 marks - 2, 1, 2]

Each note on a piano keyboard is one semi-tone apart. The ratio of frequencies between each semitone is 5.946%.

This means that if one note has a frequency of f_1 and another higher note has a frequency of f_2 , then

$$1.05946^x = \frac{f_2}{f_1}$$

where *x* the number of semitones between the two notes.

a) Apply logarithms of base ten to both sides of the above equation and hence obtain a rule for x in terms of f_1 and f_2 .

Middle C has a frequency of 261.63 Hz.

- b) The next C on the keyboard, which is an octave higher, has a frequency of 523.25 Hz. Show the use of your formula from part a) to verify that there are 12 semitones in an octave.
- c) An interval between two notes is called a "perfect fifth" if they are 7 semi-tones apart. Calculate the frequency of the note that is a perfect fifth higher than middle C.