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 Mathematics Diagnostic Test ► Preview

**Started on** Friday, 27 July 2018, 3:53 PM

**State** Finished

**Completed on** Friday, 27 July 2018, 3:53 PM

**Time taken** 11 secs

**Grade** 0.00 out of 100.00

### Question 1

Not answered

Marked out of 5.00

Assuming that the denominators are never zero, which of the following statements are true in general?

Select **all** the true statements - there may be more than one.

- ☐  $\left(\frac{6}{x}\right)^2 = \frac{36}{x}$
- ☐  $\frac{a}{b} \left(\frac{c}{d}\right) = \frac{a+c}{b d}$
- ☐  $\left(\frac{6}{x}\right)^2 = \frac{36}{x^2}$
- ☐  $\frac{1}{x} \left(x + \frac{1}{x}\right) = 1 + \frac{1}{2x}$
- ☐  $\frac{x}{a b} + \frac{y}{a c} = \frac{c x + b y}{a b c}$

### Question 2

Not answered

Marked out of 5.00

Functions  $g$  and  $h$  are defined on suitable domains by  $g(x) = 3^{-3x}$  and  $h(x) = \frac{x^2}{9} + 2$ .

Given that  $h(g(x)) = 3^{f(x)} + 2$ , find an expression for  $f(x)$ .

Which one of the following is the correct expression for  $f(x)$ ?

- ☐  $-6x - 2$
- ☐  $2 - \frac{x^2}{3}$
- ☐  $12x$
- ☐  $-3x - 2$

**Question 3**

Not answered

Marked out of 5.00

(a) Rewrite the quadratic function  $f(x) = 4x^2 - 16x + 15$  in the form  $f(x) = a(x - p)^2 + q$ .

$$f(x) = \text{?}*(x-\text{?})^2+\text{?}$$

(b) Which type of stationary point does this function have? (No answer given) ▼

(c) What are the coordinates of the stationary point?

$$(x, y) = ( \text{ } , \text{ } )$$

**Question 4**

Not answered

Marked out of 5.00

Given that  $\cos(x) = \frac{6}{7}$  for the acute angle  $x$ , find the value of  $\cos(2x)$ .

Give an exact answer as a fraction, for example  $23/73$ . Do not give the answer as a decimal number.

**Question 5**

Not answered

Marked out of 5.00

The expression  $15 \sin(x) + 8 \cos(x)$  can be written in the form  $A \sin(x + \varphi)$ , where  $A > 0$  and  $-\pi < \varphi < \pi$ .

Find the values of  $A$  and  $\varphi$ . Give the value of  $\varphi$  in radians, correct to at least three decimal places.

$$A = \text{ }$$

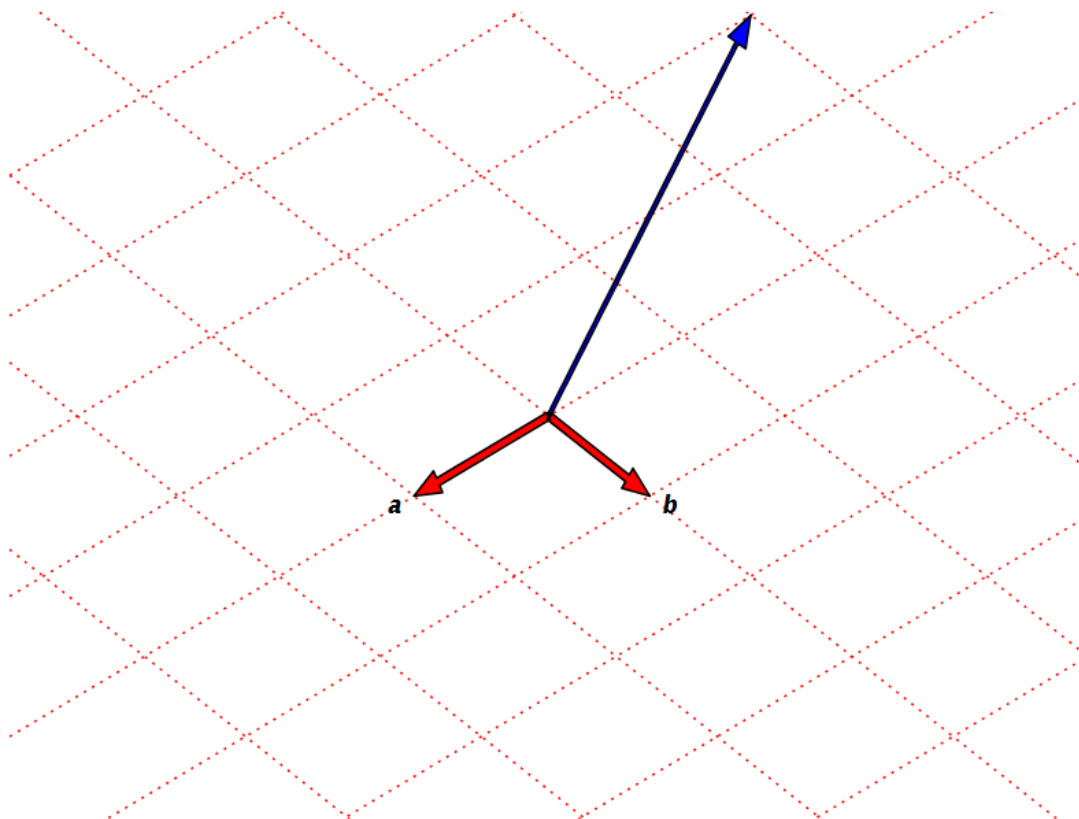
$$\varphi = \text{ }$$

**Question 6**

Not answered

Marked out of 5.00

The vectors **a** and **b** lie in the plane as indicated on the diagram. The other vector shown is  $p\mathbf{a} + q\mathbf{b}$  where  $p$  and  $q$  are both integers.



Give the values of  $p$  and  $q$ :

$p =$

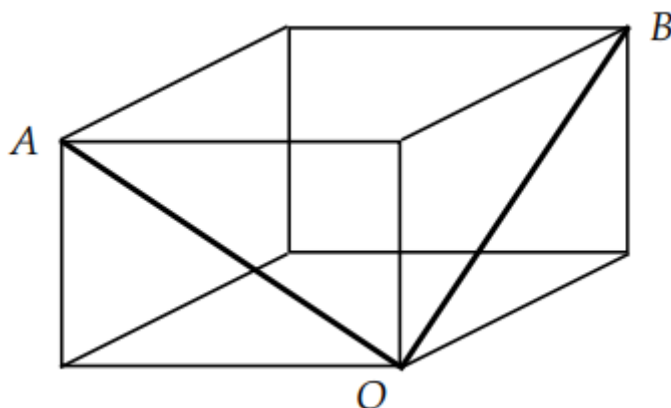
$q =$

**Question 7**

Not answered

Marked out of 5.00

A chemical factory has a rectangular room, with corners  $A$ ,  $O$  and  $B$  as shown. The floor of the room is  $2\text{ m} \times 5\text{ m}$  and the height of the room is  $2\text{ m}$ .



An engineer needs to bend a pipe at  $O$  so that it runs in a straight line from  $A$  to  $O$ , then bends at  $O$ , and then runs in a straight line from  $O$  to  $B$ .

What is the angle of the bend at  $O$ ? Give your answer in degrees, correct to at least 1 decimal place.

**Question 8**

Not answered

Marked out of 5.00

Express  $2 \ln(cu) - \ln\left(\frac{u}{t}\right)$  as a single logarithm.

Which one of the following is the correct result?

- ☐  $\ln(c^2 t u)$
- ☐  $\ln\left(\frac{c^2 u^3}{t}\right)$
- ☐  $\ln\left(2cu - \frac{u}{t}\right)$
- ☐  $\ln\left(c^2 u^2 + \frac{t}{u}\right)$

**Question 9**

Not answered

Marked out of 5.00

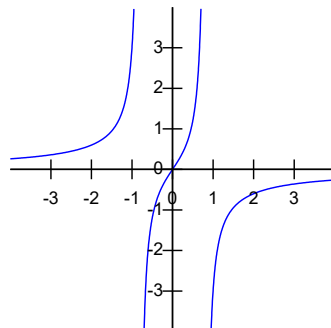
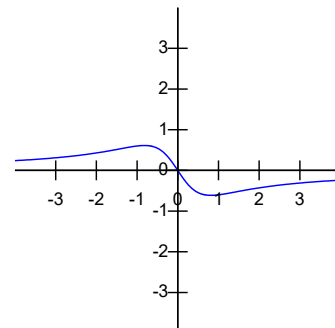
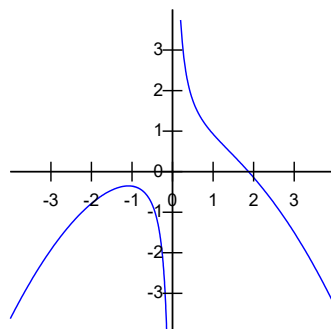
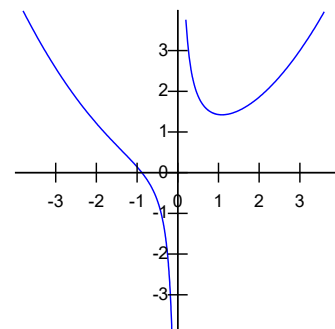
Complete the statements below:

- The curve with equation  $y = -\frac{3x}{3x^2 - 2}$  is plotted in graph

(No answer given) ▼

- The curve with equation  $y = \frac{-7x^3 + 15x + 18}{28x}$  is plotted in graph

(No answer given) ▼

**Graph A****Graph B****Graph C****Graph D**

**Question 10**

Not answered

Marked out of 5.00

You are given the two equations

$$\left. \begin{array}{l} x + a y + b = 0 \\ -2x - 3y - 8 = 0 \end{array} \right\} \quad (*)$$

where  $a$  and  $b$  are constants.

For each of the following statements, decide if it is always, sometimes or never true.

For those which you decide are "sometimes" true, give examples of values for  $a$  and  $b$  which make the statement true.

1. The system (\*) has no solutions. (No answer given) ▼

If you think "sometimes" then give an example:  $a =$    $b =$

2. The system (\*) has precisely one solution. (No answer given) ▼

If you think "sometimes" then give an example:  $a =$    $b =$

3. The system (\*) has precisely two solutions. (No answer given) ▼

If you think "sometimes" then give an example:  $a =$    $b =$

4. The system (\*) has infinitely many solutions. (No answer given) ▼

If you think "sometimes" then give an example:  $a =$    $b =$

**Question 11**

Not answered

Marked out of 5.00

Given two integers  $a$  and  $b$ ,

- $\max(a, b)$  denotes the maximum of  $a$  and  $b$ , e.g.  $\max(10, 20) = 20$ ,
- $\min(a, b)$  denotes the minimum of  $a$  and  $b$ , e.g.  $\min(10, 20) = 10$ .

(a) Evaluate the following expressions:

$\max(\min(10, 8), 12) =$

$\min(\max(10, 8), 12) =$

(b) Give values of  $a, b, c$  for which the following inequality is **false**:

$$\max(\min(a, b), c) > \min(\max(a, b), c).$$

$a =$

$b =$

$c =$

**Question 12**

Not answered

Marked out of 5.00

At what point on the graph of  $y = x^2 - x - 3$  is the slope equal to  $-1$ ?

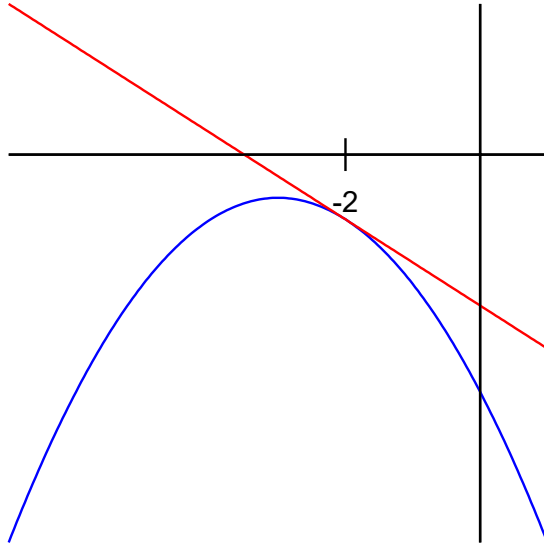
$(x, y) = ( \text{ } , \text{ } )$ .

**Question 13**

Not answered

Marked out of 5.00

The curve with equation  $y = -t^2 - 6t - 11$  has a tangent at  $t = -2$ , as shown in the diagram.



The tangent has equation  $y = mt + c$ . What are the values of  $m$  and  $c$ ?

$m =$

$c =$

**Question 14**

Not answered

Marked out of 5.00

A curve has equation  $y = -\frac{x^3}{3} + 3x^2 - 33x - 8$ .

The line  $y = mx + c$  is a tangent to the curve at the point  $(a, b)$ .

(a) Find the values of  $m$  to complete the following statements:

- When  $a = -2$ ,  $m =$
- When  $a = 1$ ,  $m =$

(b) What is the maximum value of  $m$ , over all possible values of  $a$ ?

**Question 15**

Not answered

Marked out of 5.00

The curve  $y = \frac{2x^3}{3} - 2x^2 - 2$  has two stationary points. Complete the table below to show the  $x$ -coordinates of the stationary points and their nature.

*Note* : Enter the  $x$ -coordinates in ascending order, i.e. with the smaller first.

$x$	Nature
	(No answer given) ▼
	(No answer given) ▼

**Question 16**

Not answered

Marked out of 5.00

Which one of the following is the derivative of  $\cos(ax^2 + b)$  with respect to  $x$ ?

- ☐  $-2ax \sin(ax^2 + b)$
- ☐  $-2ax \sin(2ax)$
- ☐  $2ax \cos(ax^2 + b)$
- ☐  $-\sin(2ax)$

**Question 17**

Not answered

Marked out of 5.00

Which one of the following is the derivative of  $(2x^2 + 6)^3$  with respect to  $x$ ?

- ☐  $6(2x^2 + 6)^2$
- ☐  $\frac{(2x^2 + 6)^4}{16x}$
- ☐  $48x^5$
- ☐  $12x(2x^2 + 6)^2$

**Question 18**

Not answered

Marked out of 5.00

Find the exact value of  $\int_1^3 \frac{5}{x^3} dx$ .

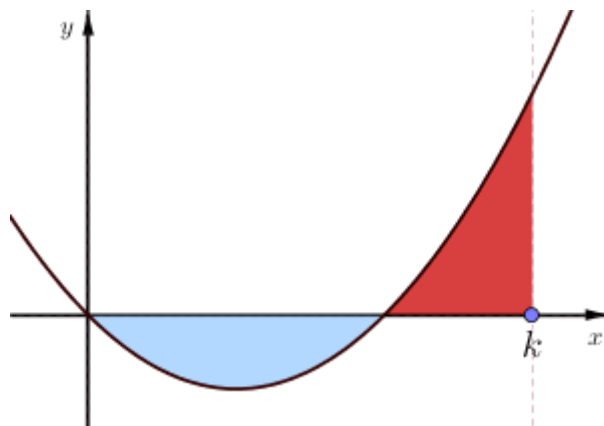
Give your answer as a fraction, for example 17/33.

**Question 19**

Not answered

Marked out of 5.00

The curve with equation  $y = 3x^2 - 15x$  is shown in the diagram.



Find the value of  $k$  for which the two shaded areas are equal.

$k =$

**Question 20**

Not answered

Marked out of 5.00

The function  $f(x)$  is such that  $f(4) = 11$  and its derivative  $f'(4) = -7$ .

Given that  $g(x) = xf(x)$ , what is the value of  $g'(4)$ ?

$g'(4) =$