2016 National 5 Paper 1

Click to jump to question:

Marks are indicated in brackets after each question number

Question 1, (2)

$$\frac{1}{2}\underline{p} + \underline{q} = \frac{1}{2}\begin{pmatrix} 4 \\ -6 \end{pmatrix} + \begin{pmatrix} -5 \\ -1 \end{pmatrix} = \begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} -5 \\ -1 \end{pmatrix} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$$

Question 2, (2)

$$\frac{3}{4}\left(\frac{1}{3} + \frac{2}{7}\right) = \frac{3}{4}\left(\frac{7}{21} + \frac{6}{21}\right) = \frac{3}{4}\left(\frac{13}{21}\right) = \frac{39}{84} = \frac{13}{28}$$

Question 3, (3)

$$\text{Area} = \frac{45}{360} x\ \pi\ x\ 20^2$$

$$= \frac{1}{8}\ x\ 400\ x\ 3.14$$

$$= 50\ x\ 3.14$$

$$= \frac{100\ x\ 3.14}{2}$$

$$= \frac{314}{2}$$

$$= 157\ cm^2$$

Question 4, (1) (1) (4)

a) $2c + 3d = 9.6$

b) $3c + 4d = 13.3$

c) $2c + 3d = 9.6$ (1)

$3c + 4d = 13.3$ (2)

Multiply (1) by 3 and (2) by 2 to give

$6c + 9d = 28.8$ (3)

$6c + 8d = 26.6$ (4)

(3) – (4) gives

$d = 2.2$

Substitute $d = 2.2$ into (1) to give

$2c + (3\ x\ 2.2) = 9.6$

$2c + 6.6 = 9.6$

$2c = 3$

$c = 1.5$

So, Dress requires $2.2\ m^2$ and cloak requires $1.5\ m^2$

Question 5, (3) (1)

a) $D = (3, 100),\ E = (15, 340)$

$$m_{DE} = \frac{340 - 100}{15 - 3}$$

$$= \frac{240}{12}$$

$$= 20$$

Using $y - b = m(x - a)$ with (3, 100) gives

$y - 100 = 20(x - 3)$

$y - 100 = 20x - 60$

$y = 20x + 40$

$W = 20A + 40$

b) $W = 20A + 40$

1 year = 12 months

$W = (20\ x\ 12) + 40$

$= 280\ kg$

Question 6, (2)

$f(x) = 7x^2 + 5x - 1$

$a = 7, b = 5, c = -1$

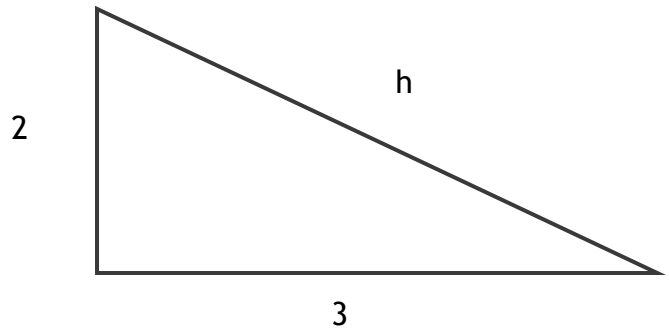
$b^2 - 4ac = 25 - 4\ x\ 7\ x\ (-1) = 53$

Since $b^2 - 4ac > 0$ there are two roots

Question 7, (1) (3)

a) $B = (8, 4, 0)$ by inspection of the graph

b) Create a right-angled triangle in the base



Using Pythagoras, we have

$h = \sqrt{2^2 + 3^2} = \sqrt{13}$

$(AV)^2 = 6^2 + (\sqrt{13})^2$

$= 49$

$AV = 7$

Question 8, (3)

$$\frac{2x}{3} - \frac{5}{6} = 2x$$

Multiplying by 6 gives

$$4x - 5 = 12x$$

$$8x = -5$$

$$x = -\frac{8}{5}$$

Question 9, (2)

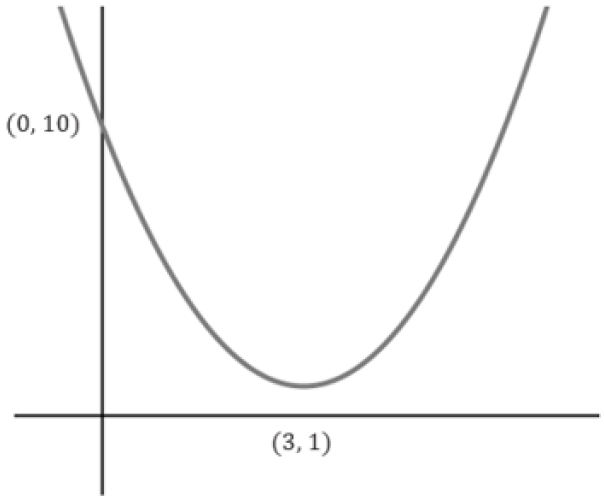
$$f(x) = \frac{2}{\sqrt{x}}$$

$$f(5) = \frac{2}{\sqrt{5}}$$

$$= \frac{2}{\sqrt{5}} x \frac{\sqrt{5}}{\sqrt{5}}$$

$$= \frac{2\sqrt{5}}{5}$$

Question 10, (3)



Question 11, (2)

$tan^2x\ cos^2x$

Use $\tan x = \dfrac{\sin x}{\cos x}$ to give

$$tan^2x\ cos^2x = \left(\frac{\sin x}{\cos x}\right)^2 cos^2x$$

$$= \frac{sin^2x}{cos^2x} \bullet cos^2x$$

$$= sin^2x$$

Question 12, (1) (3) (3)

a) Area of rectangle $= (2x+1)(x+8)$

b) Area of triangle $= \dfrac{1}{2}(3x)(2(x+5))$

$$= 3x(x+5)$$

Area of rectangle = area of triangle

$$(2x+1)(x+8) = 3x(x+5)$$

$$2x^2 + 17x + 8 = 3x^2 + 15x$$

Simplifying gives $x^2 - 2x - 8 = 0$

c) $x^2 - 2x - 8 = 0$

$$(x-4)(x+2) = 0$$

$$x = -2, x = 4$$

Since x is a length it cannot be negative, so $x = 4$

Length $= 8 + 4 = 12\ cm$

Breadth $= (2\ x\ 4) + 1 = 9\ cm$

2016 National 5 Paper 2

Question 1, (3)

$35 \; x \; 0.92^3 = 27.25$

Sugar content $= 27.25$ grams

Question 2, (2)

Weight $= 12 \div 1.5 \; x \; 10^9$

$= 0.000000008$

$= 8 \; x \; 10^{-9}$ grams

Question 3, (1)

$\overrightarrow{BD} = \underline{v} - \underline{u}$

Question 4, (2)

$3x^2 - 48$

$= 3\left(x^2 - 16\right)$

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

Question 5, (3)

$EOA = 180 - 143 = 37°$

So, $OAC = 37°$ since Z angle

So, $CAB = 90 - 37 = 53°$ since tangent to circle makes $90°$ angle with radius

$ACB = 53°$ since same angle as CAB

So, $B = 180 - \left(53 \; x \; 2\right) = 74°$

Question 6, (4) (2)

a) Mean $= \bar{x} = \dfrac{13 + 16 + 10 + 22 + 5 + 12}{6} = 13$

x	$x - \bar{x}$	$(x - \bar{x})^2$
13	0	0
16	3	9
10	-3	9
22	9	81
5	-8	84
12	-1	1
		$\sum (x - \bar{x})^2 = 164$

Standard Deviation $= \sqrt{\dfrac{164}{5}} = 5.73$

b) The mean has increased and the standard deviation has decreased. This means that, on average, Sophie had to wait longer on the phone than Jack, but since the standard deviation has decreased her waiting times were more consistent than they were for Jack.

Question 7, (5)

Volume of large cone $= \dfrac{1}{3}\pi r^2 h$

$= \dfrac{1}{3}\ x\ \pi\ x\ 16^2\ x\ 24$

$= 6{,}400\ cm^3$ to 2 s.f.

Volume of small cone $= \dfrac{1}{3}\pi r^2 h$

$$= \frac{1}{3}\ x\ \pi\ x\ 9^2\ x\ 13.5$$

$$= 1{,}100\ cm^3 \text{ to 2 s.f.}$$

Volume of carton $= 6{,}400 - 1{,}100 = 5{,}300\ cm^3$ to 2 s.f.

Question 8, (3)

Using the Sine Rule gives

$$\frac{\sin x}{150} = \frac{\sin 66}{140}$$

$$\sin x = \frac{\sin 66}{140}\ x\ 150$$

$$\sin x = 0.978\ .\ .\ .$$

$$x = sin^{-1}(0.978\ldots)$$

$$x = 78.2°$$

Question 9, (2)

$$x^2 + 8x - 7 = (x+4)^2 - 23$$

Question 10, (3)

$$\left(n^2\right)^3\ x\ n^{-10}$$

$$= n^6\ x\ n^{-10}$$

$$= n^{-4}$$

$$= \frac{1}{n^4}$$

Question 11, (3)

Linear scale factor $= \frac{60}{100} = 0.6$

Area scale factor $= 0.6^2 = 0.36$

Cost $= £13.75\ x\ 0.36 = £4.95$

Question 12, (3)

$$L = \sqrt{4kt - p}$$

$$L^2 = 4kt - p$$

$$L^2 + p = 4kt$$

$$\frac{L^2 + p}{4t} = k$$

Question 13, (3)

$$\frac{3}{x-2} + \frac{5}{x+1}$$

$$= \frac{3(x+1)}{(x-2)(x+1)} + \frac{5(x-2)}{(x-2)(x+1)}$$

$$= \frac{3(x+1) + 5(x-2)}{(x-2)(x+1)}$$

$$= \frac{8x - 7}{(x-2)(x+1)}$$

Question 14, (3)

$$2\tan x + 5 = -4$$

$$2\tan x = -9$$

$$\tan x = -4.5$$

$$x = tan^{-1}(-4.5)$$

$$x = 77^\circ$$

Using CAST we have

$$x = 180 - 77 = 103^\circ$$

$$x = 360 - 77 = 283^\circ$$

Question 15, (4)

Let M be the midpoint of AB

$MB = 4.5$

Make a right triangle OMB. Then using Pythagoras we have

$6.6^2 = (OM)^2 + 4.5^2$

$(OM)^2 = 6.6^2 - 4.5^2 = 23.31$

$OM = \sqrt{23.31} = 4.8$ cm

Height = OM + radius

$= 4.8 + 6.6$

$= 11.4\ cm$

Question 16, (4)

Using Pythagoras gives $DE = \sqrt{4^2 - 3^2} = \sqrt{7}$

Using the Sine Rule on ADE gives

$$\frac{\sin A}{a} = \frac{\sin E}{e}$$

$$\frac{\sin A}{\sqrt{7}} = \frac{\sin 90}{4}$$

$$\sin A = \frac{\sqrt{7}\sin 90}{4}$$

$$= 0.661\ldots$$

$$A = sin^{-1}(0.661\ldots)$$

$$= 41^\circ$$

Using the Cosine Rule on ABC gives

$a^2 = b^2 + c^2 - 2bc\cos A$

$= 6^2 + 10^2 - 2\ x\ 6\ x\ 10\ x\cos 41^\circ$

$$= 45.4$$

$$a = 6.7.$$

So, $BC = 6.7\ cm$